Saskatchewan
Agriculture
and Food

FINAL REPORT

CETAC-WEST

19990369

Funded by
Technology Adoption and Demonstration
March 2001

Prepared by: University of Saskatchewan

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PORK CENTRAL
Saskatchewan Agriculture and Food
Regina, Sask.

SAF-TAD HOG MANURE MANAGEMENT ASSESSMENT SURVEY

FINAL REPORT

BY CETAC-WEST

March, 2001

CETAC-WEST would like to express gratitude to the staff of Pork Central, Saskatchewan Agriculture and Food and Sask Pork for their generous support of this project.

CETAC would also like to extend a special thank-you to the Saskatchewan hog producers who participated in this survey. Without their valuable input, this project would not have been possible.

TABLE OF CONTENTS

1 Overview 3
2 Research Objectives 3
3 Methodology 4
3.1 Survey Design 4
3.2 Sampling 4
3.2.1 Target Population 4
3.2.2 Sampling Procedure 5
3.2.3 Sample Size Determination 5
4 Analysis of Results 7
4.1 Type of Hog Operation 8
4.2 Size of Hog Operation 8
4.3 Expansion of Operations 9
4.3.1 Nature of Expansion 10
4.3.2 Limiting Factors of Expansion 10
4.4 Use of Manure in Hog Operations 11
4.5 Neighbour Concern Over Manure Storage or Application 11
4.6 Type of Manure System 12
4.7 Quantity of Manure Handled Annually 13
4.8 Type of Manure Storage/Outside Storage 14
4.9 Use of Storage Covers/Type of Storage Cover 15
4.10 Feed or Ration Management 16
4.11 Use of Pit Additives 16
4.12 Approximate Annual Cost of Manure Application 17
4.13 Method of Manure Application 18
4.14 Frequency Manure is Applied 19
4.15 Manure Nutrient & Soil Testing 20
4.16 Consideration of Other Methods of Manure Management 20
4.17 Factors Which Influence Choice of Manure Management Methods 21
4.18 Manure Management Factors that are Important to Current Operations 22
4.19 Topics of Interest to Producers 23
4.20 Refusal to Participate in the Survey 24
4.21 A Growing Chasm Between Small Operators and ILO's in Saskatchewan 24
5 Conclusion 26

Index of Figures....28
Appendix 1: Survey....30
Appendix 2: Frequency Distribution Tables....32
Index of Frequency Distribution Tables....48
Appendix 3: Cross Tabulation Tables....50
Index of Cross Tabulation Tables....75

1 Overview

The competitive Western Canadian hog industry is in a unique position to substantially increase its global market share because of available land base, abundant local feed supply, and supportive service and business infrastructure, among others. The scale of hog operations within the industry has been increasing. Larger production units (over 300 sow) now account for over three-quarters of Saskatchewan hog production. However, to achieve and sustain this economic opportunity, other development realities facing intensive livestock operations must be considered. These include:

- rising environmental issues surrounding manure management (odour, GHG emissions, soil and water impact);
- social harmony with other land or resource users;
- anticipating or complying with provincial and/or municipal legislation pertaining to livestock production requirements;
- implementation of cost-effective manure handling options to integrate farm economic and environmental goals;

Through the transfer of information and technology, SAF hopes to enhance the opportunity for the sustainable growth and long-term viability of the Saskatchewan hog industry. In partnership with CETAC-WEST, Saskatchewan Agriculture and Food (SAF) would like to provide the province's producers with information on technologies that address a variety of manure management issues.

2 Research Objectives

The first step, in delivering relevant and useful information regarding hog manure management solutions to producers, was to gain an understanding of the current industry structure. This entailed establishing a profile of the Saskatchewan hog industry, clearly identifying producer needs, and determining how much they currently spend and how much they might spend to adopt manure management technologies.

The objectives of this study were to:

I. Categorize pork producers by size and manure management needs
II. Determine the current manure management practices of Saskatchewan hog producers
III. Determine technology requirements and purchasing patterns in the areas of odour control, nutrient reduction, recycling opportunities, power generation, and others as identified.

3 Methodology

The research information required to meet the objectives of this study was obtained by collecting primary data through the implementation of a survey. The survey was designed to provide a profile of Saskatchewan hog operations, as well as identify their current manure management practices and technology requirements. The survey was administered using telephone interviews.

3.1 Survey Design

The survey comprised both closed-end and open-ended questions. The closed-end questions provided either fixed responses (i.e. yes or no), or ranked responses (i.e. very important (1), important (2), neutral (3), not important (4), very unimportant (5)). Open-ended questions were used where areas of interest were probed in more detail, at times following a closed-end question. Survey questions used in this study can be found in Appendix 1.

Data from the closed-end questions were analyzed using a statistical computer application, "SPSS 10.0", that calculated frequencies and percentage distributions. The survey responses were coded, entered into the SPSS data editor, and tabulated. All data has been summarized in tabular format and can be found in Appendix 2. Selective cross-tabulations were also constructed to identify significant relationships found in the data and these can be found in Appendix 3.

3.2 Sampling

3.2.1 Target Population

As the objective of the study was to obtain a profile of the province's hog operations and their manure management practices and needs, the survey was targeted at all Saskatchewan pork producers. Statistics provided by Sask Pork indicated that in 1999 there were approximately 1319 pork producers marketing hogs in Saskatchewan. According to Sask Pork's database, approximately 90% of the producer population managed less than 100 sow operations. However, the remaining 10% of producers with larger operations accounted for three-quarters of production.

3.2.2 Sampling Procedure

A stratified probability sampling procedure was utilized to obtain an appropriate representative sample of our target population. The variable selected as an efficient basis for stratification was the size of the hog operation (number of sows). Two main subgroups of Saskatchewan hog producers were formed: those producers with under 300 sow operations and those with over 300 sow operations (ILO). We felt that responses from each group would be internally homogeneous but comparatively different between groups. Simple random samples were then provided for the subgroups from Sask Pork's database of over 1300 hog producers. This sampling method had two main benefits. First, it ensured the results would represent the real manure management needs and practices of both small and intensive operations; and secondly, it minimized the opportunity for bias by giving each hog operation an equal chance of being selected.

3.2.3 Sample Size Determination

As the survey was conducted, we determined that the true hog producer population in Saskatchewan in 2000 is not over 1300 as reported in the 1999 statistics provided from Sask Pork's producer database. The actual number is estimated to be closer to 1000 producers as the survey reported a 33% 'out-of-business' rate for producers with less than 100 sow operations. Sample size calculations were adjusted to match this estimate.

Using a statistical formula for sample size determination, we calculated that a sample size of 205 would be necessary to obtain results representative of the true population. The formula and rationale used to make this calculation are provided below.

Sample size = $n = (Z^*S/E)^2$

Where: Z = standardized value indicating confidence level
S = estimate of sample standard deviation (rule of thumb)
E = acceptable margin of error, plus or minus factor (one-half of total confidence interval)

Sample size = $n = ((1.96^*.5)/6)^2$

$n \approx 258$

A 95% confidence level (Z = 1.96), traditionally used by researchers, was applied for the purposes of this study. The confidence level is a percentage indicating the long-run probability that the results will be correct. It indicates how often the percentage of the population lies within the confidence interval.

The confidence interval (indicated by E in the formula) is the upper and lower limits that indicate the range within which the true population's response would fall. A confidence interval of ±6 was used in this study.

To illustrate, let us look at an example from the results of this study. Forty-seven (47%) of producers interviewed indicated they conduct soil tests. Using a confidence level of ± 6, since 47% of the sample indicated they do soil test you can be "sure" that if you had asked the question of the entire relevant population between 41% (47-6) and 53% (47+6) would have responded in kind. When you put the confidence level and the confidence interval together, you can say that you are 95% certain that the true percentage of the population is between 41% and 53%.

A finite population correction factor (FPC) is generally utilized when the sample size is greater than 10% of the population. Since the sample size for this study was approximately 20% of the Saskatchewan pork producer population the FPC formula was applied.

Finite Populuation Correction Factor (FPC) = Adjusted n = (n*N)/(n+N-1)
Where n = 258
N = 1000

Adjusted n = (258*1000)/(258+1000-1)
Adjusted Sample Size n ≈ 205

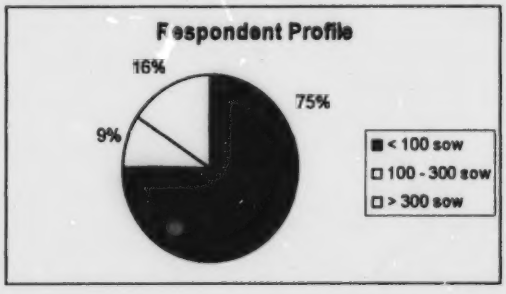
4 Analysis of Results

This section provides a summary of the survey results which identify the size and type of hog operations in Saskatchewan, correlated with manure management practices and technology requirements.

Two hundred and five (205) completed surveys were successfully collected from a total of 400 calls placed to Saskatchewan hog producers (51% success rate). Twenty-nine percent of hog producers were no longer in business and 20% of producers declined to participate in the survey. At the end of this section, we will expand on the reasons provided for the 'growing mortality rate' of small hog operations and producer reluctance to complete the survey.

One hundred and seventy-four of the surveys (75%) were completed by producers with less than 300 sow operations. Thirty-two of the producers surveyed (16%) were intensive livestock operators (ILO) with over 300 sow operations. Please note, that each of the ILO's reported on their cumulative operations and manure management practices. For example, the response of an ILO with 14 separate sites was cumulatively reported on one survey.

Figure 1

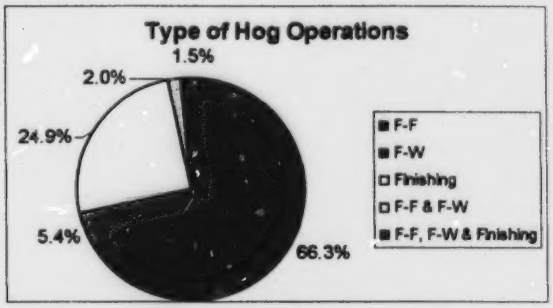


Please note, the survey results are often presented both as a percentage and a numeral. In numerical form, results are presented as a proportion of the relevant sample population. The following statement provides an example. *The majority of producers (64% or 109 of 169) handle less than 500,000 gallons of manure annually.* In this statement, 169 represents how many producers, out of the 205 surveyed, answered that particular question regarding quantity of manure handled on an annual basis. There are several reasons why the relevant population for a particular question does not always equal the survey population. In some instances, the question may not have been applicable to the producer, or the producer may not have known the answer to the question or been reluctant to provide an answer. One-hundred and nine (109) represents how many of the 169 producers who replied to the question handle less than 500,000 gallons of manure annually. Sixty-four percent (64%) is the numerical proportion of producers expressed as a percentage.

4.1 Type of Hog Operation

The majority of producers surveyed (66% or 136 of 205) have farrow-to-finish operations. Finishing barn operators comprised the next largest group within the sample (25% or 51 of 205).

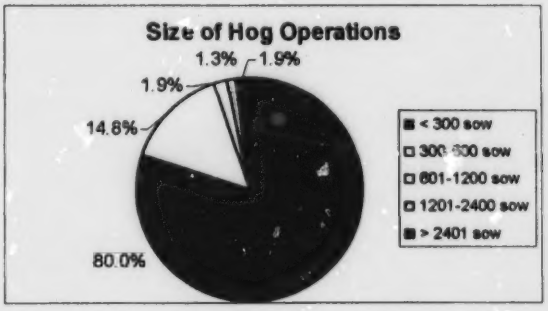
Figure 2



4.2 Size of Hog Operation

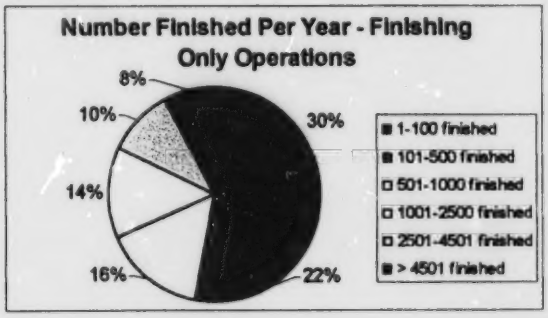
Eighty percent of hog operations surveyed (124 of 155) have less than 300 hundred sow (excluding finishing only operations). As mentioned, the majority of these operations are actually small producers with less than 100 sow.

Figure 3



Over half of the finishing operations (52% or 27 of 51) that participated in the survey finish 500 hogs or less per year. Thirty-percent (15 of 51) reported finishing between 501 and 2500 hogs per year, while the remaining 18% of producers (9 of 51) finish over 2500 hogs per year.

Figure 4



4.3 Expansion of Operations

Only 20% of producers (42 of 205) felt they would be expanding their operations in the future. The remaining 80% of respondents reported they would not be expanding due to their financial situation, current markets, labour requirements, and government policy. A few producers stated they would be going out of business within the year.

Figure 5

Sixty percent of the producers (25 of 42) who were expanding operations had farrow-to-finish operations. Finishing only operations accounted for one third of producers (14 of 42) who were planning an expansion.

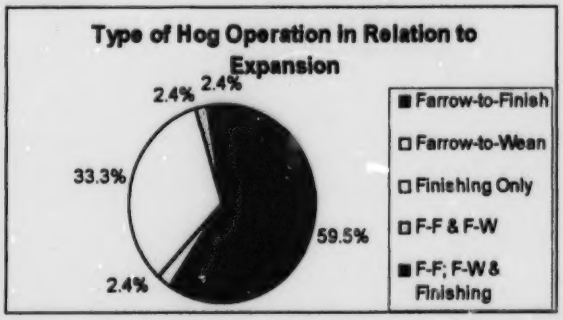


Figure 6

The majority of the producers (excluding finishing only operations) who are planning to expand are small producers with less than 300 sow operations (82% or 23 of 28).

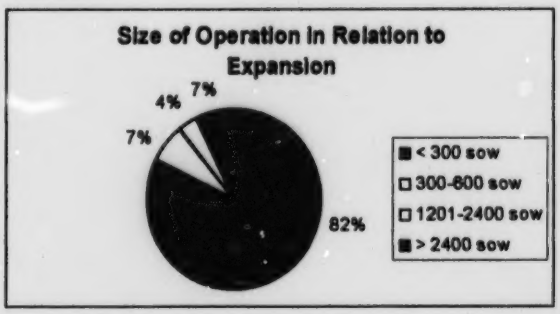
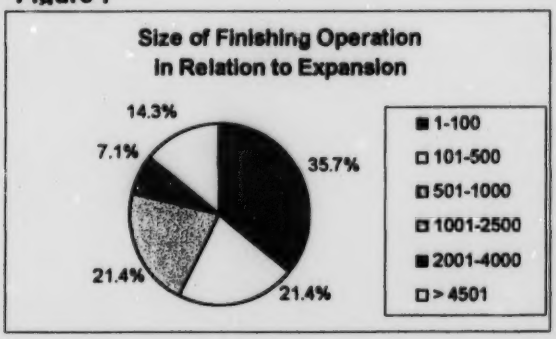


Figure 7

Both small and large producers with finishing only barns are planning on expanding their operations in the future. Fifty-seven percent of expansion (8 of 14) will be undertaken by producers who finish less than 500 hogs annually. The remaining 43% of producers (6 of 14) will expand barns that already finish over 1000 sow per year.



4.3.1 Nature of Expansion

Ninety-percent of planned expansion by producers was to increase the size of operations (increase number of sows or finishers). Generally, producers were doubling or tripling their operations. One producer reported an ambitious expansion from 20,000 sow currently to 90,000 sow in 2008.

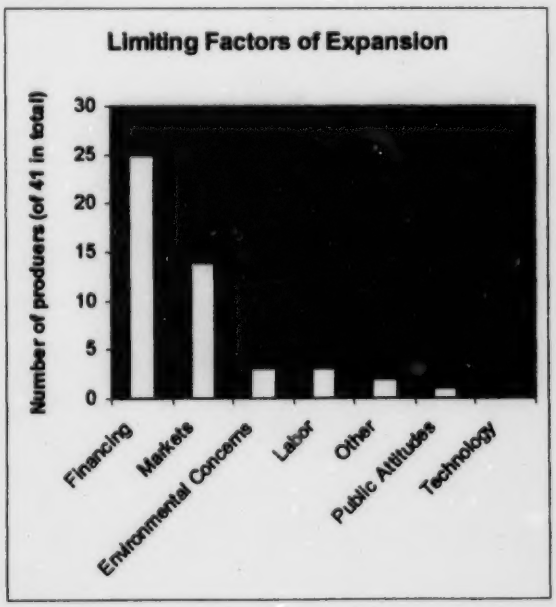
Ten percent of expansion will be to diversify to a different type of hog operation. For example, one producer is adding a finishing only barn to his current farrow-to-finish operations.

4.3.2 Limiting Factors of Expansion

Those producers, planning to expand, identified financing (61% or 25 of 41) and markets (34% or 14 of 41) as the two most limiting factors of expansion. Environmental concerns, labor, public attitudes, technology did not play a large part in their plans.

The majority of producers who felt financing and markets would be limiting factors to expansion were farrow-to-finish producers with under 300 sow (74% or 14 of 19) and finishing only operators who finish less than 500 hogs annually (67% or 4 of 6).

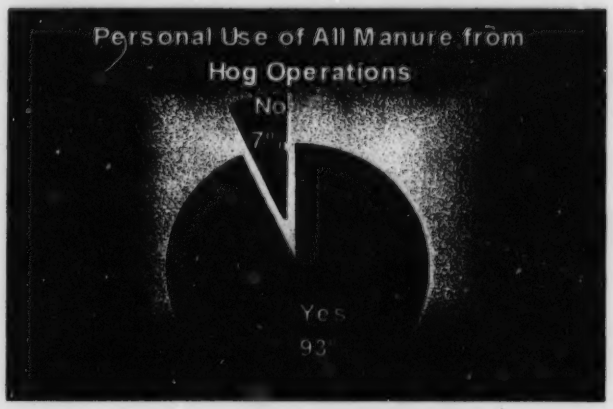
Figure 8



4.4 Use of Manure in Hog Operations

Nearly all producers (93% or 190 of 205) claimed they personally utilize all the manure from their hog operations. The remaining producers (7% or 15 of 205) who do not utilize all of their own manure primarily give the manure to neighbours, family and friends who use it as a fertilizer. Only a couple producers indicated they contract their manure to local farmers (for profit). One producer stated they sell the manure to people in the city who use it for their gardens.

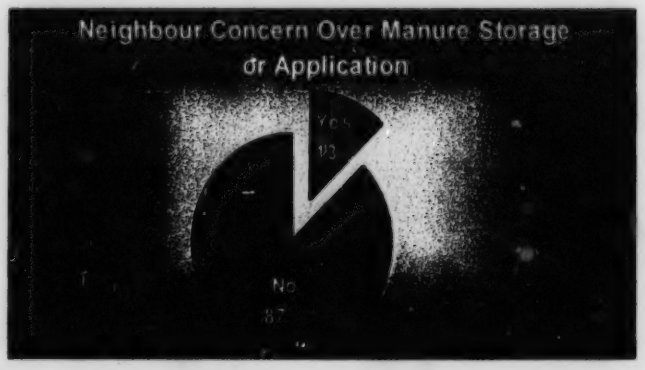
Figure 9



4.5 Neighbour Concern Over Manure Storage or Application

The majority of producers (87% or 177 of 203) claim they have received no serious complaints from their neighbours regarding their manure storage or application. The only complaints reported were problems with odour from the operation.

Figure 10



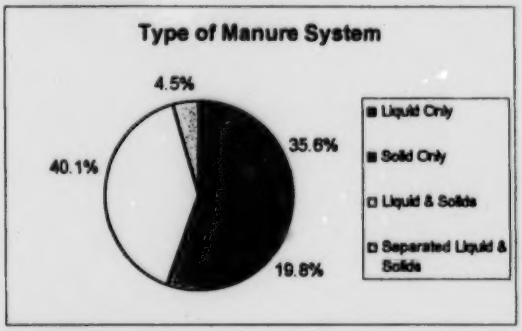
Many respondents stated that the regular draw down of manure from the lagoon, injection of manure into the land, as well as ice cover on the lagoon in winter, helps minimize problems with odour.

Small producers reported they did not have many problems with neighbours because they handle their manure in a considerate manner. For example, they don't spread the manure next to a neighbour's yard, or if the wind is blowing in a certain direction.

4.6 Type of Manure System

The two main categories of manure systems reported by producers were liquid and solids systems (40% of operations or 81 of 202) and strictly liquid systems (35% of operations or 72 of 202).

Figure 11



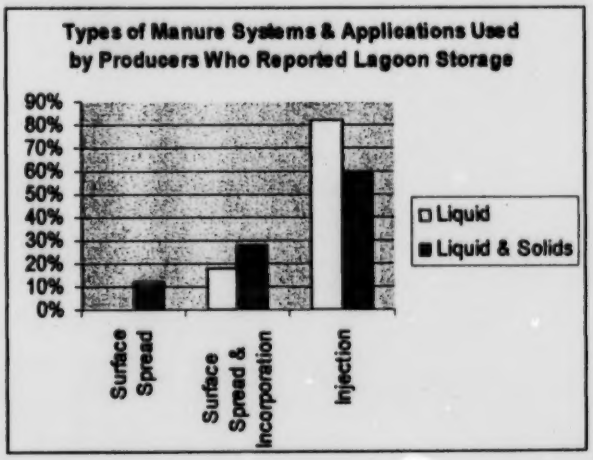
Intensive livestock operators (ILO's) with greater than 300 sow operations reported using only liquid or liquid and solids systems. Small operations with less than 300 sow also used solid systems (stockpiling).

Please note, the results of this particular question may contain some inaccuracy due to an misinterpretation on behalf of producers as to classifying their current system within the categories provided: liquid, solids, liquid & solids, separated liquid and solids.

For instance, 4.5% of producers (9 of 202) reported the use of a separated liquid and solids system. Closer examination revealed that these producers were primarily small operators who had shallow pits in their barn and/or who stockpiled their manure. These producers do not actually use separation technologies and should not have been categorized in this manner.

Another example is the difference in manure systems used by operations that had lagoon storage. Fifty-two percent of producers with lagoons (34 of 66) classified their manure system as strictly a liquid system. The other half of lagoon owners classified their system as a liquid and solids system.

Figure 12

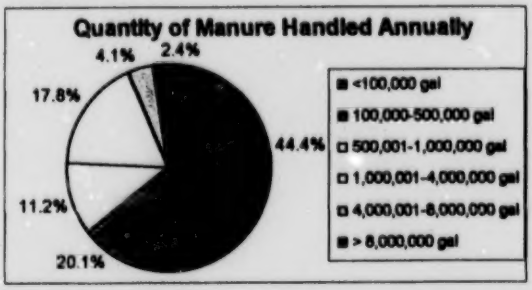


Regardless of the manure system used, producers with lagoon storage preferred to use an injection method of manure application.

4.7 Quantity of Manure Handled Annually

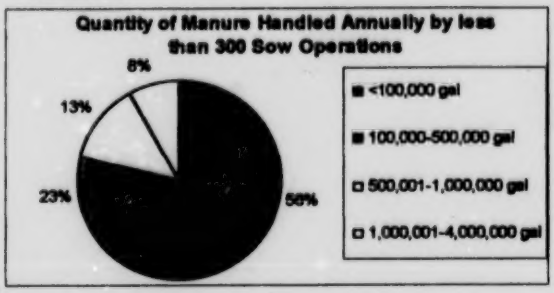
The majority of producers (64% or 109 of 169) handle less than 500,000 gallons of manure annually.

Figure 13



The quantities of manure handled by various sizes of hog operations (excluding finishing only) are as follows:

Figure 14



- Over half of the producers with less than 300 sow operations (56% or 56 of 100) handle under 100,000 gallons of manure annually. However, 8% indicated they handle 1 million to 4 million gallons of manure annually.
- Eighty-two percent of producers with 300 to 600 sow operations (18 of 22 who reported) handled between one to four million gallons of manure annually.
- All of the producers surveyed who have 600 to 1200 sow operations handle four to eight million gallons of manure annually.
- Producers with 1201 to 2400 sow operations handle over four million gallons of manure annually.
- Operations with over 2400 sow handle over eight million gallons of manure annually.

The quantities of manure handled by various sizes of finishing only operations are as follows:

- Operations that finish less than 2500 sow annually handle under 500,000 gallons of manure each year.
- Finisher barns that handle 2500 to 4500 sow per year generally manage 500,000 to one million gallons of manure annually.

- Those operations that finish over 4500 sow annually handle one to four million gallons of manure each year.
- None of the finishing barn operators surveyed reported handling over four million gallons of manure annually.

4.8 Type of Manure Storage/Outside Storage

Sixty-seven percent of producers (139 of 205) maintain shallow pits in their barns with outside storage. All producers with over 300 sow operations reported using shallow pits in their barns with outside storage.

Figure 15

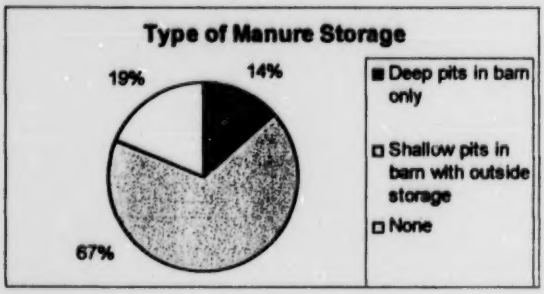
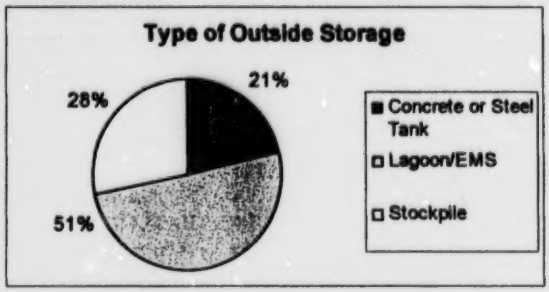


Figure 16



Fourteen percent of producers (28 of 205) have deep pits in their barn only, while 19% of producers (38 of 205) do not have a manure storage system at all. Producers in these two categories all have less than 300 sow operations.

Fifty-one percent of producers who have outside storage (66 of 131) use a lagoon or earthen manure storage. The other half of producers who use outside storage are split between stockpiling manure (28% or 37 of 131) and using a concrete or steel tank storage (21% or 28 of 131).

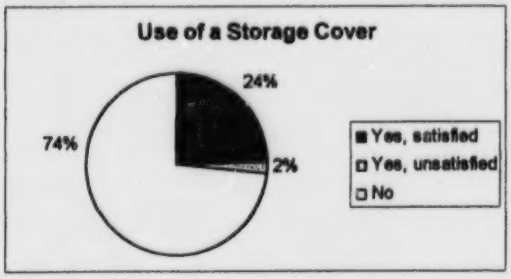
Stockpiling is mainly practiced by producers with less than 300 sow. However, two finishing operations that handled 500 to 1000 hogs per year reported stockpiling their manure.

Only producers with less than 600 sow reported the use of concrete or steel tank storage. Seventy-one percent of these producers (20 of 28) have operations with less than 300 sow.

4.9 Use of Storage Covers/Type of Storage Cover

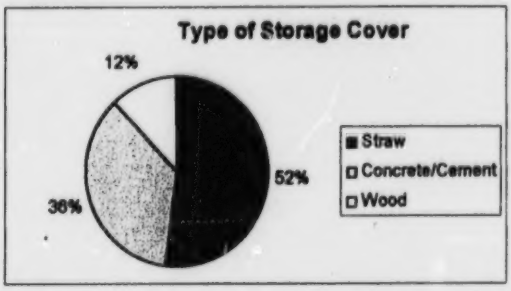
Approximately one quarter (26% or 23 of 86) of producers who have outside storage (lagoon or concrete/steel tank) reported they use a storage cover.

Figure 17



Straw was used as a cover by half of the producers (52% or 13 of 25) who covered their outside manure storages. Eighty-five percent of producers (11 of 13) who use straw covers are satisfied with the results. The two producers who were dissatisfied with the performance of the straw coverage felt that it did not provide adequate odour coverage and stated that straw has a tendency to sink to the bottom of the storage making it difficult to pump out the manure. Other producers who do not currently use a straw cover also commented on the reduced ease of manure handling at pump out. Straw was the only type of cover reported by sixty-six producers who had lagoon storage (20% or 13 of 66).

Figure 18

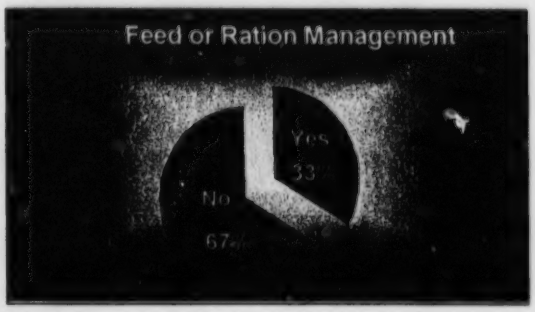


Other methods of covering outside manure storages included using concrete and wood. Producers who used concrete of steel tank storages primarily covered the storage with concrete. Two producers used wood to cover pits alongside their barn. These methods provided satisfactory odour control.

Overall, the majority of producers do not feel there is a necessity to cover their manure storage. Given the smaller size of the majority of operations, many do not have handle huge quantities of manure and the time between storage and land application is shortened. As well, outside manure storages generally freeze over in the winter, minimizing odour.

4.10 Feed or Ration Management

Figure 19



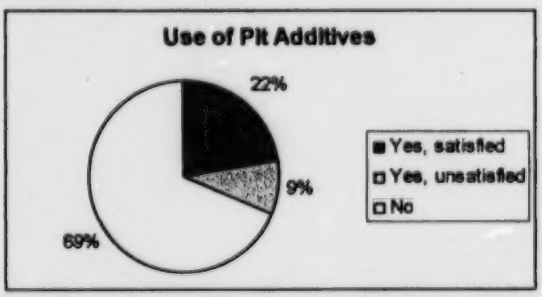
One-third (68 of 204) of producers reported that they do manage feed or rations to control manure production, nutrients or odour. Several producers, with varying sizes of operations, reported the use of feed additives. A popular comment was the use of hull-less barley in the animal feed. Two producers stated they use phytase (enzyme) to increase the digestion process and reduce the production of phosphorus in the manure.

Although small producers may make adjustments when they notice some feed will achieve certain results over others, they do not consider themselves to be actively managing feed and rations to control manure.

A few producers mentioned they manage feed to provide the best gain in productivity; controlling manure production is a secondary benefit.

4.11 Use of Pit Additives

Figure 20



Approximately, one-third of producers use pit additives (41 of 131) to reduce either the odour or solids content of the manure.

Nearly 90% of producers (34 of 39) who use pit additives have less than 600 sow operations.

Seventy percent of producers (29 of 41) who currently use pit additives reported they were satisfied with the results. The additives were able to reduce solids and gas emissions (both ghg and odour producing).

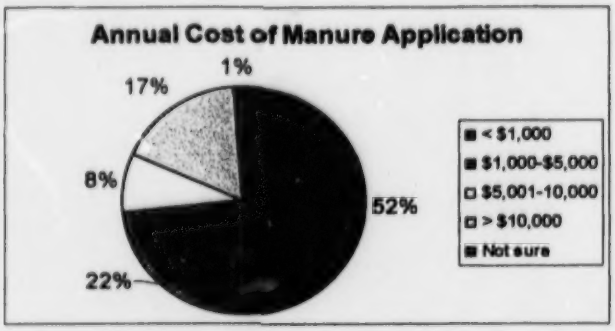
However, there are also several producers who do not currently use pit additives or are planning on discontinuing their use because the additive results were inconsistent and they were not

satisfied. Due to the particular additive's inability to reduce odour and suspend solids, the associated costs outweighed any visible benefits.

4.12 Approximate Annual Cost of Manure Application

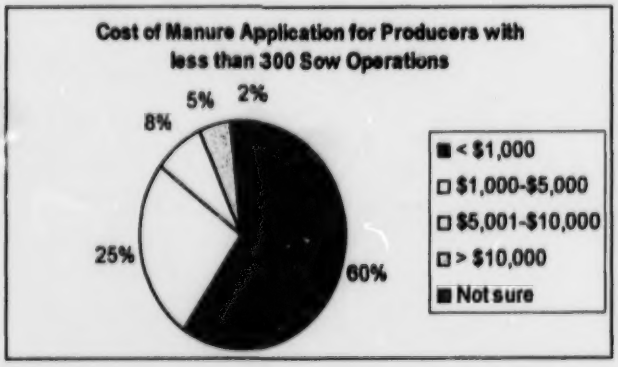
Fifty-two percent of producers who responded (104 of 203) spend less than $1,000 annually for manure application.

Figure 21



The majority of producers with less than 300 sow operations (85% or 104 of 122) spend less than $5,000 on manure application each year. However, a small percentage (7% or 16 of 122) are spending greater than $5,000 annually. (Figures exclude finishing only barns)

Figure 22



Twenty-eight percent of producers with 300-600 sow operations (5 of 23) spend $5,000 to $10,000 on manure application annually. Nearly three quarters of 300-600 sow operations (72% or 18 of 23) have annual manure application expenses of $10,000 or greater. (Figures exclude finishing only barns)

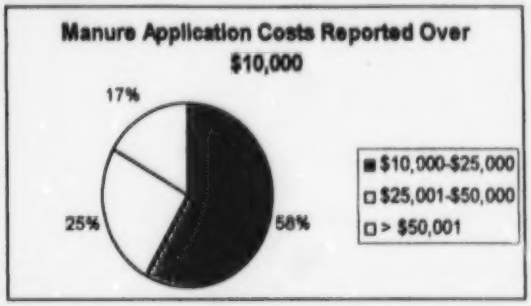
All producers, with greater than 600 sow operations, reported spending $10,000 or more on manure application annually. (Figures exclude finishing only barns)

Three-quarters of finishing only operations with less than 2500 hogs finished per year (31 of 41) spend under $1,000 for manure application. The remaining 25% (10 of 41) spend between

$1,000 - $5,000 annually. Annual manure application costs for operations with 2501-4500 hogs finished per year were primarily $1,000 to $5,000. Finishing operations with greater than 4500 hogs per year tended to spend over $10,000 annually.

The majority of producers with manure application costs over $10,000 per year (58% or 14 of 24 who responded) generally spend in the range of $10,000 to $25,000. Twenty-five percent of producers who spend over $10,000 annually (6 of 24) had approximate application costs between $25,001 and $50,000. The largest producers with manure application costs over $50,000 (4 of 24) reported expenditures of $60,000, $80,000, $250,000 and $800,000 annually.

Figure 23



Eleven additional producers were not able to give an approximate figure although they spent over $10,000 in application costs annually.

4.13 Method of Manure Application

The most widely used method of manure application is surface spread and incorporation (119 of 202), followed by injection (58 of 202) and straight surface spreading (24 of 202). Irrigation is only practiced by four of the producers who were surveyed. The few producers who comprised the other category either have a small number of hogs that stay in a corral or are allowed to roam free in the pasture. The manure eventually biodegrades where it is deposited.

Figure 24

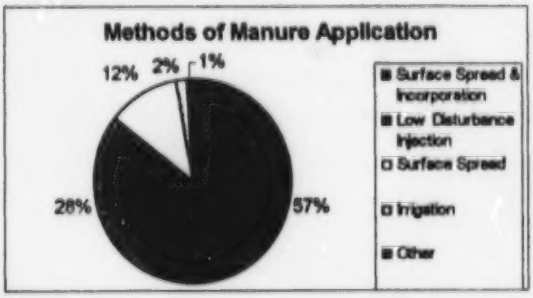
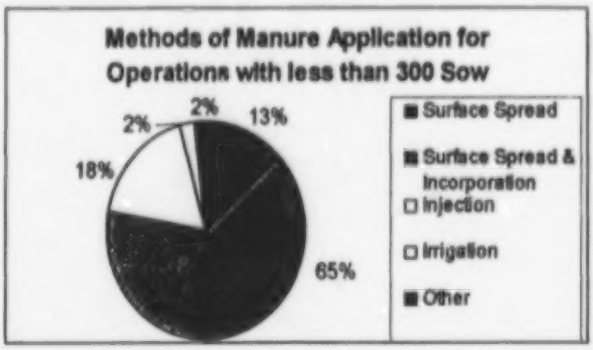


Figure 25

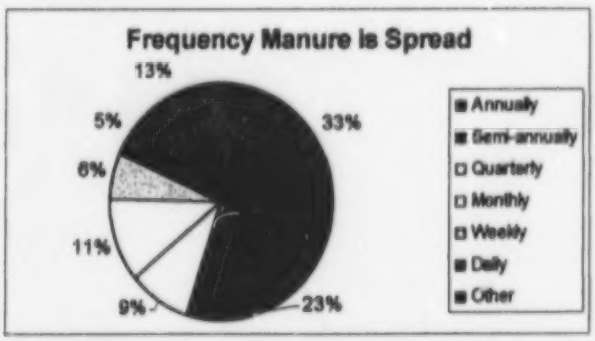


Surface spread methods of application and/or incorporation, as well as irrigation are used primarily by producers with less than 300 sow operations. On the other hand, the majority of ILO's (87% or 27 of 31) practice low disturbance injection methods of application. Please note, that although surface spread methods of application are practiced by a greater number of small producers, the majority of land under manure in the province is injected.

Many ILO's, who practice manure injection, hire custom operators to draw-down the storage and inject the manure into the land. This increases the cost of application by several thousand dollars. The custom application fees commonly reported ranged from $15,000 to $30,000. Several smaller operations reported using custom haulers to spread stockpiled manure. Generally, the rates for this service remained under $5,000.

4.14 Frequency Manure is Applied

Figure 26



Over half of producers who responded (108 of 196) apply manure either annually or semi-annually.

Smaller operations with less than 300 sow or 100 finishers applied manure more frequently on a monthly, weekly or daily basis.

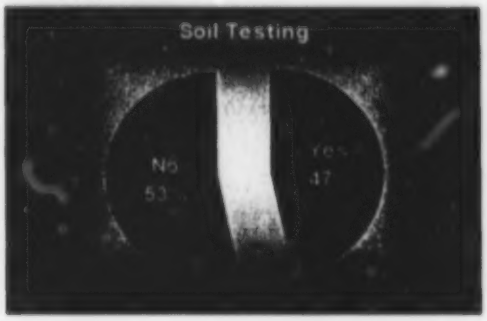
Those producers who fell into the other category primarily reported applying manure once every 2-4 years (6% or 12 of 196), bi-monthly (2% or 4 of 196), and every 2 months (3% or 6 of 196).

4.15 Manure Nutrient & Soil Testing

Over ninety-percent of respondents (186 of 204) did not test the manure produced by their operations for nutrients. However, almost half of respondents (95 of 204) did undertake soil testing.

Figure 27

Figure 28

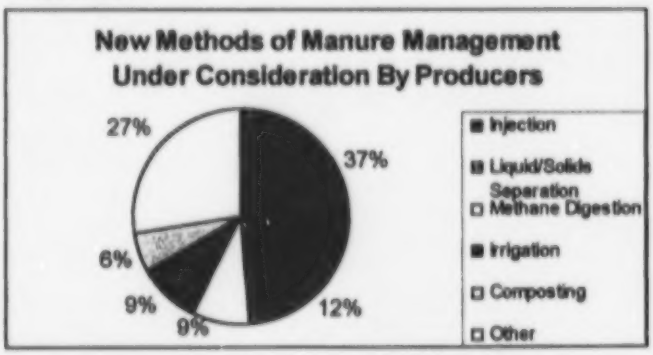


The majority of producers could not comment on the associated costs of nutrient or soil testing. The average costs reported for soil testing ranged between $25 to $65 per field or $100 to $300 per year. Please note, ILO's reported larger annual expenditures due to increased land requirements for manure application, and a need to determine the manure's nutrient levels for use as fertilizer by neighboring farmers. For example, one ILO stated they spend $9,000 per year on manure nutrient testing and $3,000-$4,000 per year on soil testing.

4.16 Consideration of Other Methods of Manure Management

Only 16% of respondents (33 of 204) indicated they would consider other methods of manure management.

Figure 29

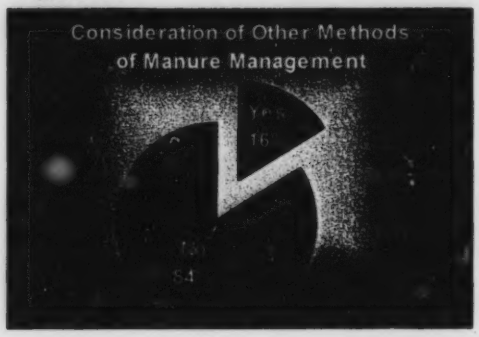


Almost 40% of those producers (12 of 33) who indicated they were considering other manure management methods were interested in the injection of manure into the land. These producers currently use a surface spread method of manure application.

Many producers were also interested in liquid/solids separation, methane digestion, effluent irrigation, and composting. One producer was interested in the accurate testing of manure ingredients. Another was investigating the possibility of a permanent cover or chemically treating the manure.

Eighty-four percent of producers (171 of 204) surveyed are not currently considering alternative methods of manure management.

Figure 30



Many producers feel they are already utilizing the most cost-effective and/or efficient methods of manure management for their needs.

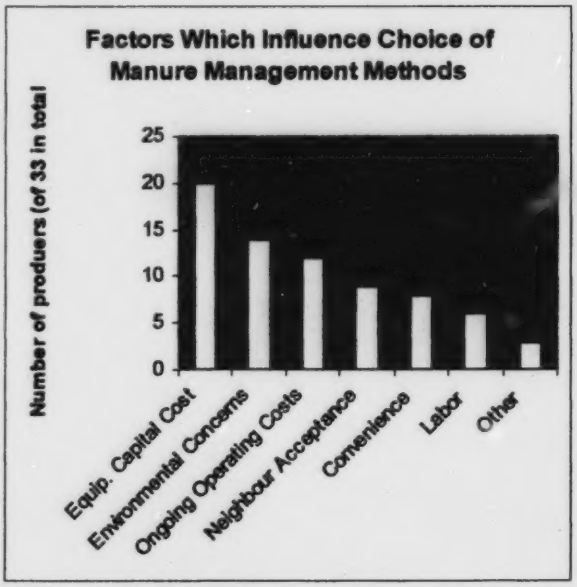
Small operations do not have a large enough quantity of manure expense to justify spending money on a new manure handling system. As well, many of the small producers are planning on leaving the industry or retiring, therefore they are not interested in any new technologies.

4.17 Factors Which Influence Choice of Manure Management Methods

For those producers who were considering other manure management methods, equipment capital cost (20 of 33), ongoing operating costs (12 of 33), and environmental concerns (14 of 33) were the top three factors that would influence their choice of an alternative manure management method.

A few producers mentioned that the ability to more effectively use manure (nutrients in manure) was also a factor that would influence their choice of management methods.

Figure 31

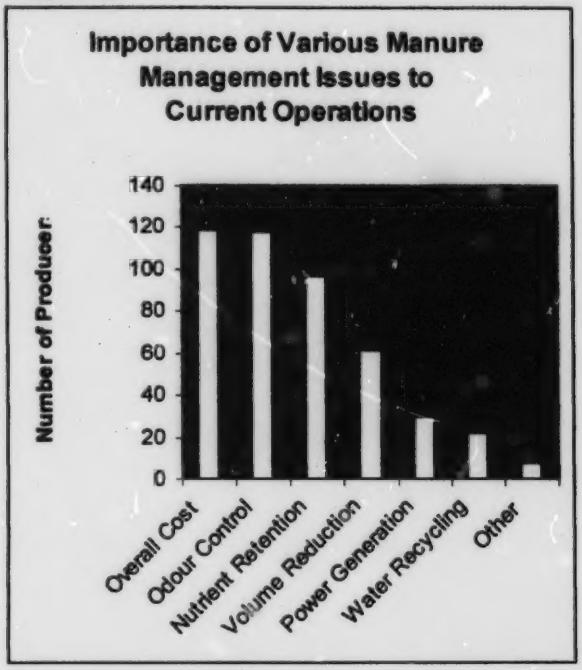


4.18 Manure Management Factors that are Important to Current Operations

All producers were asked to rank the importance of several manure management issues relative to their current operations. The overall cost of manure management and odour control were ranked as the most important issues. The remaining issues in decreasing order of importance were manure nutrient retention, volume reduction of manure, power generation, and water recycling opportunities.

Soil and groundwater contamination, as well as a means to dispose of all the manure were additional issues important to the producer's operation.

Figure 32



Producers with less than 300 sow felt that they were too small to take advantage of 'power generation' and 'water recycling opportunities'. However, they are interested in these concepts and would like to use them if they were economically viable.

In general, producers felt they have an excellent water supply and therefore ranked water-recycling opportunities as relatively unimportant.

Figure 33

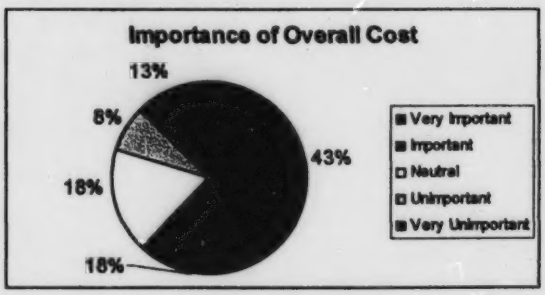


Figure 34

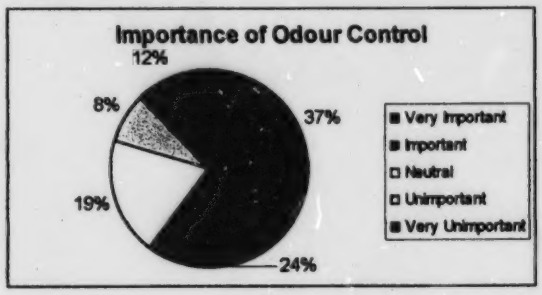


Figure 35

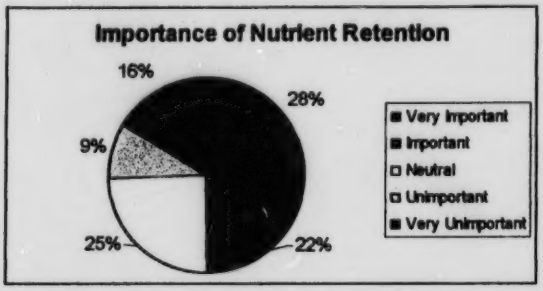


Figure 36

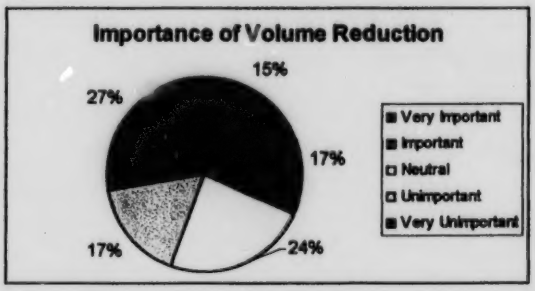


Figure 37

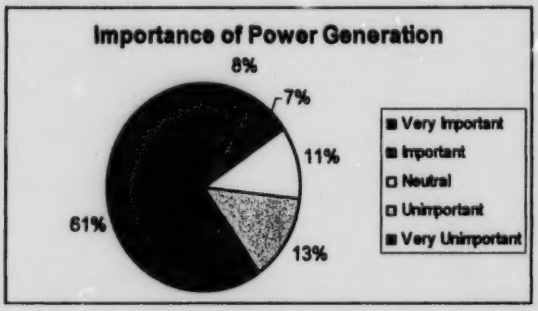
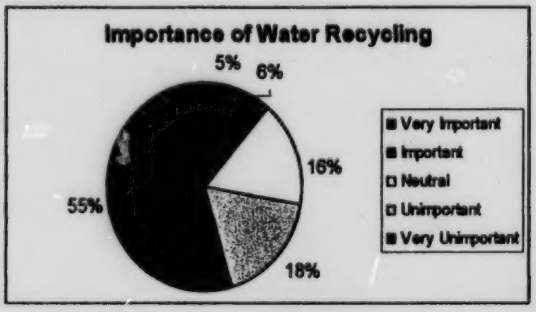


Figure 38



4.19 Topics of Interest to Producers

Eighty percent of producers (158 of 197) were interested in learning more about using manure as a fertilizer. There is a general feeling that hog manure is an excellent fertilizer. However there is concern over the variability and inconsistency of the fertilizer that is spread each time.

Figure 39

Figure 40

Figure 41

4.20 Refusal to Participate in the Survey

Many of the producers who declined to participate simply did not wish to take the time to complete another survey. Others did not feel the survey was a value-added activity. They had been farming for years and spreading manure on the land as fertilizer. They did not feel someone should tell them how to manage their manure/operations.

There are also strong feelings in the small producer community against any cash outflows that are not directed to providing financial assistance for the family farm and rural Saskatchewan.

Some producers resented the fact that the money spent on this project was not allocated to their own operations and instead wasted on 'research of no value'. They commented that they did not need to be told how to raise hogs but needed assistance in selling them.

Another producer stated they did not feel they owed the government any reciprocity by answering a survey. When instead of assisting the small producer, the government was trying to 'run them out of business' by providing large producers (Big Sky) with millions of dollars.

There was also mistrust by producers that their responses would be used against them in the future to enforce increased rules and regulations. Many did not feel comfortable giving information out over the phone.

4.21 A Growing Chasm Between Small Operators and ILO's in Saskatchewan

Approximately 30% of producers with less than 100 sow reported that they have gone out of the hog operation business and did not complete a survey. Respondents commented that poor markets and competition from larger producers have created a harsh environment for small producers and the family farm.

Many small producers stated they feel alienated by a government which is infusing large hog operations with millions of dollars instead of sharing the wealth equally and supporting family farms and rural Saskatchewan.

A couple producers commented that the government's support of ILO's is destroying rural Saskatchewan by tearing small communities apart and pitting one community against another. One respondent indicated they were the only producer remaining in their area, all others had gone out of business. They felt there was no assistance for small or young producers.

Now that the SPI centers are closed, one producer indicated that they simply could not compete against the economies of scale enjoyed by larger operations. In order to market their hogs they now have to ship them across the province. This is not an economically viable alternative as the transportation costs are more than the hogs are worth.

One respondent voiced their concern over the monopoly large producers will have over the market and the price of pork.

There were also comments regarding the increased possibility of water contamination and the reduction in the water table by larger operations.

5 Conclusion

Based on the statistical results from the survey conducted, the following is a "profile" of the typical Saskatchewan hog producer.

- Operates a farrow-to-finish barn
- Has less than 300 sow
- Will not be expanding their operations in the near future
- Personally uses all the manure from own operations
- Has not received any serious complaints from neighboring landowners or communities
- Handles less than 500,000 gallons of manure annually
- Spends less than $5,000 on manure application annually
- Uses a surface spread and incorporation method of manure application
- Applies manure annually or semi-annually
- Has shallow pits in their barn with outside lagoon storage
- Does not use feed or pit additives
- Does not use a storage cover
- Does not test for manure nutrient content
- Tests for soil nutrient content
- Is not considering other methods of manure management
- Overall cost, odour control, and nutrient retention respectively are the most important manure management issues with respect to operations
- Is interested in learning more about manure as a fertilizer

Please note, the above profile reflects the large number of small operations that comprise the industry. It does not provide an accurate summary of ILO's who, while fewer in number, account for three-quarters of the hogs marketed in Saskatchewan.

ILO's have greater manure management requirements and must adopt practices that minimize the social and environmental impacts of hog manure. In particular, larger operations:

- Handle a minimum of one to four million gallons of manure annually
- Spend over $10,000 on manure application annually
- Use a low disturbance injection method of manure application (the majority of land under manure in Saskatchewan is injected)

Industry Leaders

A small percentage of producers indicated they were interested in expansion and innovation. Those producers who were interested in expanding, planned to double or triple the size of their operation. Expansion was not limited to Intensive Livestock Operations (ILO's), the majority of producers considering expansion had small to medium sized operations (less than 300 sow).

Thirty-three producers surveyed indicated an interest in other methods of manure management. The majority of these producers were interested in injection of manure. Other producers indicated an interest in separation, digestion, composting, permanent lagoon covers and chemical treatment of manure.

For those producers who were considering other manure management methods, equipment capital cost, ongoing operating costs, and environmental concerns were the top three factors that would influence their decision to adopt alternative manure management technologies.

The industry feedback received while conducting the survey confirms that irrespective of size, those producers who want to remain in the competitive hog industry need to have information on technologies that address a variety of manure management issues.

The results also indicate that although some producers in the industry are willing to consider the adoption of new technologies to deal with environmental concerns, these solutions must be economically viable. The industry's tight profit margins will not support the adoption of expensive manure management technologies, unless a case can be made for marketable by-products or cost savings in other areas.

Index of Figures

Figure 1: Respondent Profile..... 7
Figure 2: Type of Hog Operations 8
Figure 3: Size of Hog Operations..... 8
Figure 4: Number Finished Per Year – Finishing Only Operations..... 8
Figure 5: Type of Hog Operation in Relation to Expansion..... 9
Figure 6: Size of Operation in Relation to Expansion..... 9
Figure 7: Size of Finishing Operation in Relation to Expansion..... 9
Figure 8: Limiting Factors of Expansion..... 10
Figure 9: Personal Use of All Manure From Hog Operations..... 11
Figure 10: Neighbour Concerns Over Manure Management Practices 11
Figure 11: Type of Manure System..... 12
Figure 12: Type of Manure & Application Systems Used By Producers Who Reported Lagoon Storage..... 12
Figure 13: Quantity of Manure Handled Annually 13
Figure 14: Quantity of Manure Handled Annually by less than 300 Sow Operations .. 13
Figure 15: Type of Manure Storage..... 14
Figure 16: Type of Outside Storage..... 14
Figure 17: Use of a Storage Cover..... 15
Figure 18: Type of Storage Cover..... 15
Figure 19: Feed or Ration Management..... 16
Figure 20: Use of Pit Additives..... 16
Figure 21: Annual Cost of Manure Application..... 17
Figure 22: Cost of Manure Application for Producers with less than 300 Sow Operations..... 17
Figure 23: Manure Application Costs Reported Over $10,000..... 18
Figure 24: Methods of Manure Application..... 18
Figure 25: Methods of Manure Application for Operations with less than 300 Sow..... 19
Figure 26: Frequency Manure is Spread..... 19
Figure 27: Manure Nutrient Testing..... 20
Figure 28: Soil Testing..... 20
Figure 29: New Methods of Manure Management Under Consideration By Producers..... 20

Figure 30: Consideration of Other Methods of Manure Management..... 21
Figure 31: Factors Which Influence Choice of Manure Management Methods..... 21
Figure 32: Importance of Various Manure Management Issues to Current User..... 22
Figure 33: Importance of Overall Cost..... 22
Figure 34: Importance of Odour Control..... 22
Figure 35: Importance of Nutrient Retention 23
Figure 36: Importance of Volume of Reduction..... 23
Figure 37: Importance of Power Generation..... 23
Figure 38: Importance of Water Recycling..... 23
Figure 39: Interest in Using Manure as a Fertilizer..... 23
Figure 40: Interest in Other Methods of Handling & Applying Manure..... 23
Figure 41: Interest in Cost & Return of Various Manure Management Methods..... 23

Appendix 1:

Manure Management Assessment Telephone Survey

Saskatchewan Agriculture and Food

SASKATCHEWAN PORK CEDITERE

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CETAC-WEST

MANURE MANAGEMENT QUESTIONNAIRE

Hello, my name is _____. On behalf of Saskatchewan Agriculture and Food, CETAC-WEST is conducting a survey to determine the manure management needs and technology requirements of Saskatchewan hog producers. The data collected from these surveys will be used to design information materials and workshops on technologies that provide the best manure management solutions for Saskatchewan hog producers.

Would you be the best person to answer a few questions regarding your hog operations and manure management practices? *(If no, then ask for a referral to the appropriate person)* Would you be able to take a few minutes (8-10 min) right now to complete the survey with me? Your responses will remain confidential and be reported in aggregate form only. *(If respondent is unavailable, try to reschedule survey for a more convenient time)*

Name/Company: _____

Location: _____

Phone: _____

---

1. Please categorize the type and size of your hog operation.....

- ☐ Farrow to Finish: ..... ☐ <300 sow ☐ 300-600 sow ☐ 601-1200 sow ☐ 1201-2400 sow ☐ >2400 sow
- ☐ Farrow to Wean: ..... ☐ <300 sow ☐ 300-600 sow ☐ 601-1200 sow ☐ 1201-2400 sow ☐ >2400 sow
- ☐ Finishing Only: ..... Number finished per year _____

2. Are you considering expanding your operations? ..... ☐ Yes *(If yes, go to #3)* ☐ No *(If no, go to #5)*

3. If yes, what will be the nature of your expansion? ..... ☐ Expand type of hog operation To what? _____
..... *(please refer to question #1)* ☐ Expand size of hog operation By how much? _____ sow/finishers

4. What do you think expansion will be most limited by?..... ☐ Markets ☐ Financing ☐ Environmental Concerns
☐ Technology ☐ Labour ☐ Public Attitudes

5. Do you personally make use of all the manure from your hog operation?..... ☐ Yes *(If yes, go to #7)* ☐ No *(If no, go to #6)*

6. If no, what do you do with the remaining manure? ..... _____

7. Have you experienced any concerns over your manure storage or application from neighbours? ..... ☐ Yes ☐ No

8. What is the approximate annual cost of manure application?.... ☐ < $1000 ☐ $1000 - $5000 ☐ $5001 – $10,000
☐ > $10,000, *Please specify approximate amount* _____
☐ Not sure

9. Please categorize the type of manure system you use and quantity of manure handled on a per year basis? .....

Type:	Quantity:	
☐ Liquid:	☐ < 100,000 gal	☐ 100,001-500,000 gal
☐ Solid:	☐ 500,001- 1,000,000 gal	☐ 1,000,001-4,000,000 gal
☐ Liquid & Solids:	☐ 4,000,001-8,000,000 gal	☐ Not sure
☐ Separated Liquid & Solids:	☐ > 8,000,000 gal, *Please specify amount* _____	

10. What type of manure storage do you use?..... ☐ Deep pits in barn only ☐ Shallow pits in barn with outside storage
Outside storage type ..... ☐ Concrete or steel tank ☐ Earthen manure storage (EMS)
☐ Stockpile

11. Do you manage feed or rations to reduce manure production, manure nutrients or odour? ..... ☐ Yes ☐ No

---

12. **Do you use any pit additives; if so, are you satisfied with the additive results?** ☐ Yes, satisfied *(Go to #14)* ☐ Yes, unsatisfied *(Go to #13)* ☐ No *(Go to #14)*

13. **If unsatisfied, why are you not satisfied with pit additive results?** _____

14. **Do you use a storage cover; if so, are you satisfied with the cover results?** ☐ Yes, satisfied *(Go to #16)* ☐ Yes, unsatisfied *(Go to #15)* ☐ No *(Go to #17)*

15. **If unsatisfied, why are you not satisfied with the storage cover results?** _____

16. **If yes, what type of cover is used?** ☐ Straw ☐ Other _____

17. **What method of manure application do you use?** ☐ Surface spread ☐ Surface spread and incorporation ☐ Low disturbance injection ☐ Irrigation ☐ Other_____

18. **If surface spread application, please indicate the tanker size used and number of loads spread per month.** Tanker size _____ Number of loads/mo. _____

19. **How frequently do you spread manure?** ☐ Annually ☐ Semi-annually ☐ Other_____

20. **Do you test manure for nutrient content?** ☐ Yes ☐ No

21. **If yes, what is the approximate cost for nutrient testing?** _____

22. **Do you soil test?** ☐ Yes ☐ No

23. **If yes, what is the approximate cost for soil testing?** _____

24. **Would you, or are you, considering other methods of manure management?** ☐ Yes *(If yes, go to #25)* ☐ No *(If no, go to #27)*

25. **If yes, which methods have you considered?** _____

26. **If yes, which of the following will influence your choice of manure management methods?** ☐ Equipment capital cost ☐ Ongoing operating costs ☐ Labour ☐ Neighbour acceptance ☐ Environmental Concerns ☐ Convenience ☐ Other_____

27. **What manure management issues (i.e.: storage & application) are the most important to your operations? (Please rank each issue from 1-5 in importance, with 1 being most important)** ☐ Odour Control ☐ Power Generation (i.e.: biogas) ☐ Nutrient Retention ☐ Water Recycling Opportunities ☐ Volume Reduction ☐ Cost (i.e.: capital, operating) ☐ Additional issues _____

28. **What topics would be of interest to you concerning manure management?** ☐ Other methods of handling and applying manure ☐ Cost and return of various manure management methods ☐ Using manure as a fertilizer ☐ Other_____

Thank you for providing us with this valuable information regarding your hog operation and manure management practices. If you would like to further discuss manure management practices, please feel free to contact Karen Bolton with Pork Central, Saskatchewan Agriculture and Food, at (306) 787-9183.

Appendix 2: Frequency Distribution Tables

Please note in the following tables, the 'Missing 99' code indicates that the respondent did not answer the question/or it was missed. A 'Missing System' code indicates that the question was not relevant to the producer responding.

Table 1:

Type of hog operation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Farrow to Finish	136	66.0	66.3	66.3
	Farrow to Wean	11	5.3	5.4	71.7
	Finishing Only	51	24.8	24.9	96.6
	F-F & F-W	4	1.9	2.0	98.5
	F-F, F-W & Finishing	3	1.5	1.5	100.0
	Total	205	99.5	100.0	
Missing	99	1	.5		
Total		206	100.0		

Table 2:

Size of hog operation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< 300 sow	124	60.2	80.0	80.0
	300-600 sow	23	11.2	14.8	94.8
	601-1200 sow	3	1.5	1.9	96.8
	1201-2400 sow	2	1.0	1.3	98.1
	> 2401 sow	3	1.5	1.9	100.0
	Total	155	75.2	100.0	
Missing	System	51	24.8		
Total		206	100.0		

Table 3:

Number finished per year

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-100	16	7.8	31.4	31.4
	101-500	11	5.3	21.6	52.9
	501-1000	8	3.9	15.7	68.6
	1001-2500	7	3.4	13.7	82.4
	2001-4000	5	2.4	9.8	92.2
	> 4501	4	1.9	7.8	100.0
	Total	51	24.8	100.0	
Missing	System	155	75.2		
Total		206	100.0		

Table 4:

Expansion of operations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	42	20.4	20.5	20.5
	No	163	79.1	79.5	100.0
	Total	205	99.5	100.0	
Missing	99	1	.5		
Total		206	100.0		

Table 5:

Nature of expansion

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Expanding type of hog operation	2	1.0	4.8	4.8
	Expanding size of hog operation	38	18.4	90.5	95.2
	Both	2	1.0	4.8	100.0
	Total	42	20.4	100.0	
Missing	System	164	79.6		
Total		206	100.0		

Table 6:

Limiting factors of expansion - Markets

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	14	6.8	34.1	34.1
	No	27	13.1	65.9	100.0
	Total	41	19.9	100.0	
Missing	System	165	80.1		
Total		206	100.0		

Table 7:

Limiting factors of expansion - Financing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	25	12.1	61.0	61.0
	No	16	7.8	39.0	100.0
	Total	41	19.9	100.0	
Missing	System	165	80.1		
Total		206	100.0		

Table 8:

Limiting factors of expansion - Environmental concerns

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	3	1.5	7.3	7.3
	No	38	18.4	92.7	100.0
	Total	41	19.9	100.0	
Missing	System	165	80.1		
Total		206	100.0		

Table 9:

Limiting factors of expansion - Technology

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	41	19.9	100.0	100.0
Missing	System	165	80.1		
Total		206	100.0		

Table 10:

Limiting factors of expansion - Labour

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	3	1.5	7.3	7.3
	No	38	18.4	92.7	100.0
	Total	41	19.9	100.0	
Missing	System	165	80.1		
Total		206	100.0		

Table 11:

Limiting factors of expansion - Public attitudes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1	.5	2.4	2.4
	No	40	19.4	97.6	100.0
	Total	41	19.9	100.0	
Missing	System	165	80.1		
Total		206	100.0		

Table 12:

Other limiting factors of expansion

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	1.0	4.9	4.9
	No	39	18.9	95.1	100.0
	Total	41	19.9	100.0	
Missing	System	165	80.1		
Total		206	100.0		

Table 13:

Personal use of ALL manure from hog operation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	190	92.2	92.7	92.7
	No	15	7.3	7.3	100.0
	Total	205	99.5	100.0	
Missing	99	1	.5		
Total		206	100.0		

Table 14:

Concerns from neighbours over manure storage or application

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	26	12.6	12.8	12.8
	No	177	85.9	87.2	100.0
	Total	203	98.5	100.0	
Missing	99	3	1.5		
Total		206	100.0		

Table 15:

Approximate annual cost of manure application

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< $1,000	104	50.5	51.2	51.2
	$1,000-$5000	45	21.8	22.2	73.4
	$5,001-$10,000	17	8.3	8.4	81.8
	> $10,000	35	17.0	17.2	99.0
	Not sure	2	1.0	1.0	100.0
	Total	203	98.5	100.0	
Missing	99	3	1.5		
Total		206	100.0		

Table 16:

Type of manure system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Liquid	72	35.0	35.6	35.6
	Solid/Dry bed	40	19.4	19.8	55.4
	Liquid & Solids	81	39.3	40.1	95.5
	Separated Liquid & Solids	9	4.4	4.5	100.0
	Total	202	98.1	100.0	
Missing	99	4	1.9		
Total		206	100.0		

Table 17:

Quantity of manure handled annually

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< 100,000 gal	75	36.4	36.6	36.6
	100,000 - 500,000 gal	34	16.5	16.6	53.2
	500,001 - 1,000,000 gal	19	9.2	9.3	62.4
	1,000,001 - 4,000,000 gal	30	14.6	14.6	77.1
	4,000,001 - 8,000,000 gal	7	3.4	3.4	80.5
	> 8,000,000 gal	4	1.9	2.0	82.4
	Not sure	36	17.5	17.6	100.0
	Total	205	99.5	100.0	
Missing	99	1	.5		
Total		206	100.0		

Table 18:

Type of manure storage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Deep pits in barn only	28	13.6	13.7	13.7
	Shallow pits in barn with outside storage	139	67.5	67.8	81.5
	None	38	18.4	18.5	100.0
	Total	205	99.5	100.0	
Missing	99	1	.5		
Total		206	100.0		

Table 19:

Type of outside storage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Concrete or steel tank	28	13.6	21.4	21.4
	Earthen Manure Storage (EMS)	66	32.0	50.4	71.8
	Stockpile	37	18.0	28.2	100.0
	Total	131	63.6	100.0	
Missing	99	9	4.4		
	System	66	32.0		
	Total	75	36.4		
Total		206	100.0		

Table 20:

Feed or ration management for control of manure production, nutrients, or odour

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	68	33.0	33.3	33.3
	No	136	66.0	66.7	100.0
	Total	204	99.0	100.0	
Missing	99	2	1.0		
Total		206	100.0		

Table 21:

Use of pit additives

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes, satisfied with additive results	29	14.1	22.1	22.1
	Yes, unsatisfied with additive results	12	5.8	9.2	31.3
	No	90	43.7	68.7	100.0
	Total	131	63.6	100.0	
Missing	System	75	36.4		
Total		206	100.0		

Table 22:

Use of storage covers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes, satisfied with storage cover	21	10.2	24.4	24.4
	Yes, unsatisfied with storage cover	2	1.0	2.3	26.7
	No	63	30.6	73.3	100.0
	Total	86	41.7	100.0	
Missing	99	20	9.7		
	System	100	48.5		
	Total	120	58.3		
Total		206	100.0		

Table 23:

Type of storage cover used

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Straw	13	6.3	52.0	52.0
	Other	12	5.8	48.0	100.0
	Total	25	12.1	100.0	
Missing	99	18	8.7		
	System	163	79.1		
	Total	181	87.9		
Total		206	100.0		

Table 24:

Method of manure application - Surface spread

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	24	11.7	11.9	11.9
	No	178	86.4	88.1	100.0
	Total	202	98.1	100.0	
Missing	99	1	.5		
	System	3	1.5		
	Total	4	1.9		
Total		206	100.0		

Table 25:

Method of manure application - Surface spread & incorporation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	119	57.8	58.9	58.9
	No	83	40.3	41.1	100.0
	Total	202	98.1	100.0	
Missing	99	1	.5		
	System	3	1.5		
	Total	4	1.9		
Total		206	100.0		

Table 26:

Method of manure application - Low disturbance injection

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	58	28.2	28.9	28.9
	No	143	69.4	71.1	100.0
	Total	201	97.6	100.0	
Missing	99	1	.5		
	System	4	1.9		
	Total	5	2.4		
Total		206	100.0		

Table 27:

Method of manure application - Irrigation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	1.9	2.0	2.0
	No	198	96.1	98.0	100.0
	Total	202	98.1	100.0	
Missing	99	1	.5		
	System	3	1.5		
	Total	4	1.9		
Total		206	100.0		

Table 28:

Method of manure application - Other

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	1.0	1.0	1.0
	No	200	97.1	99.0	100.0
	Total	202	98.1	100.0	
Missing	99	1	.5		
	System	3	1.5		
	Total	4	1.9		
Total		206	100.0		

Table 29:

Frequency manure is spread

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Annually	63	30.6	32.1	32.1
	Semi-annually	45	21.8	23.0	55.1
	Quarterly	18	8.7	9.2	64.3
	Monthly	22	10.7	11.2	75.5
	Weekly	12	5.8	6.1	81.6
	Daily/Every Second Day	10	4.9	5.1	86.7
	Other	26	12.6	13.3	100.0
	Total	196	95.1	100.0	
Missing	99	5	2.4		
	System	5	2.4		
	Total	10	4.9		
Total		206	100.0		

Table 30:

Test for manure nutrient content

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	18	8.7	8.8	8.8
	No	186	90.3	91.2	100.0
	Total	204	99.0	100.0	
Missing	99	2	1.0		
Total		206	100.0		

Table 31:

Test soil

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	95	46.1	46.6	46.6
	No	109	52.9	53.4	100.0
	Total	204	99.0	100.0	
Missing	99	1	.5		
	System	1	.5		
	Total	2	1.0		
Total		206	100.0		

Table 32:

Consideration of other methods of manure management

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	33	16.0	16.2	16.2
	No	171	83.0	83.8	100.0
	Total	204	99.0	100.0	
Missing	99	2	1.0		
Total		206	100.0		

Table 33:

Factors which influence choice of manure management methods - Equipment capital cost

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	20	9.7	60.6	60.6
	No	13	6.3	39.4	100.0
	Total	33	16.0	100.0	
Missing	99	2	1.0		
	System	171	83.0		
	Total	173	84.0		
Total		206	100.0		

Table 34:

Factors which influence choice of manure management methods - Ongoing operating costs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	12	5.8	36.4	36.4
	No	21	10.2	63.6	100.0
	Total	33	16.0	100.0	
Missing	99	2	1.0		
	System	171	83.0		
	Total	173	84.0		
Total		206	100.0		

Table 35:

Factors which influence choice of manure management methods - Labour

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	6	2.9	18.2	18.2
	No	27	13.1	81.8	100.0
	Total	33	16.0	100.0	
Missing	99	2	1.0		
	System	171	83.0		
	Total	173	84.0		
Total		206	100.0		

Table 36:

Factors which influence choice of manure management methods - Neighbour acceptance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	9	4.4	27.3	27.3
	No	24	11.7	72.7	100.0
	Total	33	16.0	100.0	
Missing	99	2	1.0		
	System	171	83.0		
	Total	173	84.0		
Total		206	100.0		

Table 37:

Factors which influence choice of manure management methods - Environmental concerns

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	14	6.8	42.4	42.4
	No	19	9.2	57.6	100.0
	Total	33	16.0	100.0	
Missing	99	2	1.0		
	System	171	83.0		
	Total	173	84.0		
Total		206	100.0		

Table 38:

Factors which influence choice of manure management methods - Convenience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	8	3.9	24.2	24.2
	No	25	12.1	75.8	100.0
	Total	33	16.0	100.0	
Missing	99	2	1.0		
	System	171	83.0		
	Total	173	84.0		
Total		206	100.0		

Table 39:

Factors which influence choice of manure management methods - Other

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	3	1.5	9.1	9.1
	No	30	14.6	90.9	100.0
	Total	33	16.0	100.0	
Missing	99	2	1.0		
	System	171	83.0		
	Total	173	84.0		
Total		206	100.0		

Table 40:

Importance of odour control to manure management & overall operations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Important	71	34.5	36.2	36.2
	Important	47	22.8	24.0	60.2
	Neutral	38	18.4	19.4	79.6
	Unimportant	16	7.8	8.2	87.8
	Very unimportant	24	11.7	12.2	100.0
	Total	196	95.1	100.0	
Missing	99	9	4.4		
	System	1	.5		
	Total	10	4.9		
Total		206	100.0		

Table 41:

Importance of power generation to manure management & overall operations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Important	16	7.8	8.3	8.3
	Important	14	6.8	7.3	15.5
	Neutral	22	10.7	11.4	26.9
	Unimportant	26	12.6	13.5	40.4
	Very unimportant	115	55.8	59.6	100.0
	Total	193	93.7	100.0	
Missing	99	12	5.8		
	System	1	.5		
	Total	13	6.3		
Total		206	100.0		

Table 42:

Importance of nutrient retention to manure management & overall operations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Important	55	26.7	28.2	28.2
	Important	42	20.4	21.5	49.7
	Neutral	48	23.3	24.6	74.4
	Unimportant	18	8.7	9.2	83.6
	Very unimportant	32	15.5	16.4	100.0
	Total	195	94.7	100.0	
Missing	99	10	4.9		
	System	1	.5		
	Total	11	5.3		
Total		206	100.0		

Table 43:

Importance of water recycling opportunities to manure management & overall operations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Important	10	4.9	5.2	5.2
	Important	12	5.8	6.2	11.3
	Neutral	32	15.5	16.5	27.8
	Unimportant	34	16.5	17.5	45.4
	Very unimportant	106	51.5	54.6	100.0
	Total	194	94.2	100.0	
Missing	99	11	5.3		
	System	1	.5		
	Total	12	5.8		
Total		206	100.0		

Table 44:

Importance of volume reduction to manure management & overall operations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Important	29	14.1	15.0	15.0
	Important	32	15.5	16.6	31.6
	Neutral	46	22.3	23.8	55.4
	Unimportant	33	16.0	17.1	72.5
	Very unimportant	53	25.7	27.5	100.0
	Total	193	93.7	100.0	
Missing	99	12	5.8		
	System	1	.5		
	Total	13	6.3		
Total		206	100.0		

Table 45:

Importance of overall cost to manure management & overall operations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Important	85	41.3	44.3	44.3
	Important	34	16.5	17.7	62.0
	Neutral	34	16.5	17.7	79.7
	Unimportant	15	7.3	7.8	87.5
	Very unimportant	24	11.7	12.5	100.0
	Total	192	93.2	100.0	
Missing	99	13	6.3		
	System	1	.5		
	Total	14	6.8		
Total		206	100.0		

Table 46:

Additional issues of importance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	8	3.9	4.1	4.1
	No	189	91.7	95.9	100.0
	Total	197	95.6	100.0	
Missing	99	8	3.9		
	System	1	.5		
	Total	9	4.4		
Total		206	100.0		

Table 47:

Topics of interest - Cost and return of various manure management methods

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	64	31.1	32.5	32.5
	No	133	64.6	67.5	100.0
	Total	197	95.6	100.0	
Missing	99	9	4.4		
Total		206	100.0		

Table 48:

Topics of interest - Using manure as a fertilizer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	158	76.7	80.2	80.2
	No	39	18.9	19.8	100.0
	Total	197	95.6	100.0	
Missing	99	9	4.4		
Total		206	100.0		

Table 49:

Topics of interest - Other methods of handling and applying manure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	50	24.3	25.4	25.4
	No	147	71.4	74.6	100.0
	Total	197	95.6	100.0	
Missing	99	9	4.4		
Total		206	100.0		

Table 50:

Topics of interest - Other

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	22	10.7	11.2	11.2
	No	175	85.0	88.8	100.0
	Total	197	95.6	100.0	
Missing	99	9	4.4		
Total		206	100.0		

Index of Frequency Distribution Tables

Table 1: Type of hog operation 32
Table 2: Size of hog operation 32
Table 3: Number finished per year 32
Table 4: Expansion of operations 33
Table 5: Nature of expansion 33
Table 6: Limiting factors of expansion – Markets 33
Table 7: Limiting factors of expansion - Financing 33
Table 8: Limiting factors of expansion - Environmental Concerns 34
Table 9: Limiting factors of expansion – Technology 34
Table 10: Limiting factors of expansion – Labour 34
Table 11: Limiting factors of expansion – Public Attitudes 34
Table 12: Other limiting factors of expansion 35
Table 13: Personal use of all manure from hog operation 35
Table 14: Concerns from neighbours over manure storage or application 35
Table 15: Approximate annual cost of manure application 36
Table 16: Type of manure system 36
Table 17: Quantity of manure handled annually 36
Table 18: Type of manure storage 37
Table 19: Type of outside storage 37
Table 20: Feed or ration management 37
Table 21: Use of pit additives 38
Table 22: Use of storage covers 38
Table 23: Type of storage cover used 38
Table 24: Method of manure application – Surface spread 39
Table 25: Method of manure application – Surface spread & incorporation 39
Table 26: Method of manure application – Low Distrubance Injection 39
Table 27: Method of manure application – Irrigation 40
Table 28: Method of manure application – Other 40
Table 29: Frequency manure is spread 40
Table 30: Test for manure nutrient content 41
Table 31: Test soil 41
Table 32: Consideration of other methods of manure management 41
Table 33: Factors which influence choice of manure management methods – Equipment capital cost 42

Table 34: Factors which influence choice of manure management methods – Ongoing operating costs..... 42
Table 35: Factors which influence choice of manure management methods – Labour..... 42
Table 36: Factors which influence choice of manure management methods – Neighbour acceptance..... 43
Table 37: Factors which influence choice of manure management methods – Environmental concerns..... 43
Table 38: Factors which influence choice of manure management methods – Convenience..... 43
Table 39: Factors which influence choice of manure management methods – Other..... 44
Table 40: Importance of odour control to manure management & overall operations..... 44
Table 41: Importance of power generation to manure management & overall operations..... 44
Table 42: Importance of nutrient retention to manure management & overall operations..... 45
Table 43: Importance of water recycling opportunities to manure management & overall operations..... 45
Table 44: Importance of volume reduction to manure management & overall operations..... 45
Table 45: Importance of overall cost to manure management & overall operations..... 46
Table 46: Additional issues of Importance..... 46
Table 47: Topics of Interest – Other methods of handling and applying manure 46
Table 48: Topics of Interest – Cost and return of various manure management methods..... 47
Table 49: Topics of Interest – Using manure as a fertilizer..... 47
Table 50: Topics of Interest – Other..... 47

Appendix 3: Cross Tabulation Tables

TABLE 51:

Type of hog operation * Expansion of operations Crosstabulation

			Expansion of operations		
			Yes	No	Total
Type of hog operation	Farrow to Finish	Count	25	110	135
		% within Expansion of operations	59.5%	67.9%	66.2%
	Farrow to Wean	Count	1	10	11
		% within Expansion of operations	2.4%	6.2%	5.4%
	Finishing Only	Count	14	37	51
		% within Expansion of operations	33.3%	22.8%	25.0%
	F-F & F-W	Count	1	3	4
		% within Expansion of operations	2.4%	1.9%	2.0%
	F-F, F-W & Finishing	Count	1	2	3
		% within Expansion of operations	2.4%	1.2%	1.5%
Total		Count	42	162	204
		% within Expansion of operations	100.0%	100.0%	100.0%

TABLE 52:

Size of hog operation * Expansion of operations Crosstabulation

Count

		Expansion of operations		
		Yes	No	Total
Size of hog operation	< 300 sow	23	100	123
	300-600 sow	2	21	23
	601-1200 sow		3	3
	1201-2400 sow	1	1	2
	> 2401 sow	2	1	3
Total		28	126	154

TABLE 53:

Size of hog operation * Nature of expansion Crosstabulation

			Nature of expansion			
			Expanding type of hog operation	Expanding size of hog operation	Both	Total
Size of hog operation	< 300 sow	Count	1	21	1	23
		% within Nature of expansion	50.0%	87.5%	50.0%	82.1%
	300-600 sow	Count	1		1	2
		% within Nature of expansion	50.0%		50.0%	7.1%
	1201-2400 sow	Count		1		1
		% within Nature of expansion		4.2%		3.6%
	> 2401 sow	Count		2		2
		% within Nature of expansion		8.3%		7.1%
Total		Count	2	24	2	28
		% within Nature of expansion	100.0%	100.0%	100.0%	100.0%

TABLE 54:

Size of hog operation * Concerns from neighbours over manure storage or application Crosstabulation

			Concerns from neighbours over manure storage or application		
			Yes	No	Total
Size of hog operation	< 300 sow	Count	11	111	122
		% within Size of hog operation	9.0%	91.0%	100.0%
		% within Concerns from neighbours over manure storage or application	50.0%	85.4%	80.3%
	300-600 sow	Count	7	16	23
		% within Size of hog operation	30.4%	69.6%	100.0%
		% within Concerns from neighbours over manure storage or application	31.8%	12.3%	15.1%
	601-1200 sow	Count	2	1	3
		% within Size of hog operation	66.7%	33.3%	100.0%
		% within Concerns from neighbours over manure storage or application	9.1%	.8%	2.0%
	1201-2400 sow	Count		1	1
		% within Size of hog operation		100.0%	100.0%
		% within Concerns from neighbours over manure storage or application		.8%	.7%
	> 2400 sow	Count	2	1	3
		% within Size of hog operation	66.7%	33.3%	100.0%
		% within Concerns from neighbours over manure storage or application	9.1%	.8%	2.0%
Total		Count	22	130	152
		% within Size of hog operation	14.5%	85.5%	100.0%
		% within Concerns from neighbours over manure storage or application	100.0%	100.0%	100.0%

TABLE 55:

Size of hog operation * Quantity of manure handled annually Crosstabulation

			Quantity of manure handled annually							
			100,000 gal	100,000 - 500,000 gal	500,001 - 1,000,000 gal	1,000,001 - 4,000,000 gal	4,000,001 - 8,000,000 gal	> 8,000,000 gal	Not sure	Total
Size of hog operation	< 300 sow	Count	56	23	13	8			23	123
		% within Size of hog operation	45.5%	18.7%	10.6%	6.5%			18.7%	100.0%
		% within Quantity of manure handled annu	100.0%	100.0%	92.9%	30.8%			95.8%	79.9%
	300-600 sow	Count			1	18	3		1	23
		% within Size of hog operation			4.3%	78.3%	13.0%		4.3%	100.0%
		% within Quantity of manure handled annu			7.1%	69.2%	42.9%		4.2%	14.9%
	601-1200 sow	Count					3			3
		% within Size of hog operation					100.0%			100.0%
		% within Quantity of manure handled annu					42.9%			1.9%
	1201-2400 so	Count					1	1		2
		% within Size of hog operation					50.0%	50.0%		100.0%
		% within Quantity of manure handled annu					14.3%	25.0%		1.3%
	> 2400 sow	Count						3		3
		% within Size of hog operation						100.0%		100.0%
		% within Quantity of manure handled annu						75.0%		1.9%
Total		Count	56	23	14	26	7	4	24	154
		% within Size of hog operation	36.4%	14.9%	9.1%	16.9%	4.5%	2.6%	15.6%	100.0%
		% within Quantity of manure handled annu	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

TABLE 56:

Size of hog operation * Type of manure system Crosstabulation

			Type of manure system				
			Liquid	Solid/Dry bed	Liquid & Solids	Separated Liquid & Solids	Total
Size of hog operation	< 300 sow	Count	39	25	49	8	121
		% within Type of manure system	68.4%	100.0%	80.3%	88.9%	79.6%
	300-600 sow	Count	15		7	1	23
		% within Type of manure system	26.3%		11.5%	11.1%	15.1%
	601-1200 sow	Count	1		2		3
		% within Type of manure system	1.8%		3.3%		2.0%
	1201-2400 sow	Count	1		1		2
		% within Type of manure system	1.8%		1.6%		1.3%
	> 2401 sow	Count	1		2		3
		% within Type of manure system	1.8%		3.3%		2.0%
Total		Count	57	25	61	9	152
		% within Type of manure system	100.0%	100.0%	100.0%	100.0%	100.0%

TABLE 57:

Size of hog operation * Type of outside storage Crosstabulation

			Type of outside storage			
			Concrete of steel tank	Earthen Manure Storage (EMS)	Stockpile	Total
Size of hog operation	< 300 sow	Count	20	23	30	73
		% within Type of outside storage	76.9%	47.9%	100.0%	70.2%
	300-600 sow	Count	6	17		23
		% within Type of outside storage	23.1%	35.4%		22.1%
	601-1200 sow	Count		3		3
		% within Type of outside storage		6.3%		2.9%
	1201-2400 sow	Count		2		2
		% within Type of outside storage		4.2%		1.9%
	> 2401 sow	Count		3		3
		% within Type of outside storage		6.3%		2.9%
Total		Count	26	48	30	104
		% within Type of outside storage	100.0%	100.0%	100.0%	100.0%

TABLE 58:

Use of storage covers * Type of storage cover used * Type of outside storage Crosstabulation

Type of outside storage				Type of storage cover used		Total
				Straw	Other	
Concrete or Steel Tank	Use of storage covers	Yes, satisfied with storage cover	Count		7	7
			% within Use of storage covers		100.0%	100.0%
			% within Type of storage cover used		100.0%	100.0%
	Total		Count		7	7
			% within Use of storage covers		100.0%	100.0%
			% within Type of storage cover used		100.0%	100.0%
Earthen Manure Storage (EMS)	Use of storage covers	Yes, satisfied with storage cover	Count	11		11
			% within Use of storage covers	100.0%		100.0%
			% within Type of storage cover used	84.6%		84.6%
		Yes, unsatisfied with storage cover	Count	2		2
			% within Use of storage covers	100.0%		100.0%
			% within Type of storage cover used	15.4%		15.4%
	Total		Count	13		13
			% within Use of storage covers	100.0%		100.0%
			% within Type of storage cover used	100.0%		100.0%

TABLE 59:

Size of hog operation * Approximate annual cost of manure application Crosstabulation

			Approximate annual cost of manure application					
			< $1,000	$1,000-$5000	$5,001-$10,000	> $10,000	Not sure	Total
Size of hog operation	< 300 sow	Count	73	31	10	6	2	122
		% within Size of hog operation	59.8%	25.4%	8.2%	4.9%	1.6%	100.0%
		% within Approximate annual cost of manure application	100.0%	100.0%	66.7%	18.8%	100.0%	79.7%
	300-600 sow	Count			5	18		23
		% within Size of hog operation			21.7%	78.3%		100.0%
		% within Approximate annual cost of manure application			33.3%	56.3%		15.0%
	601-1200 sow	Count				3		3
		% within Size of hog operation				100.0%		100.0%
		% within Approximate annual cost of manure application				9.4%		2.0%
	1201-2400 sow	Count				2		2
		% within Size of hog operation				100.0%		100.0%
		% within Approximate annual cost of manure application				6.3%		1.3%
	> 2400 sow	Count				3		3
		% within Size of hog operation				100.0%		100.0%
		% within Approximate annual cost of manure application				9.4%		2.0%
Total		Count	73	31	15	32	2	153
		% within Size of hog operation	47.7%	20.3%	9.8%	20.9%	1.3%	100.0%
		% within Approximate annual cost of manure application	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

TABLE 60:

Size of hog operation * Frequency manure is spread Crosstabulation

			Frequency manure is spread							
			Annually	Semi-annually	Quarterly	Monthly	Weekly	Daily/Every Second Day	Other	Total
Size of hog operation	< 300 sow	Count	35	21	13	18	8	7	12	114
		% within Size of hog operation	30.7%	18.4%	11.4%	15.8%	7.0%	6.1%	10.5%	100.0%
		% within Frequency manure is spread	77.8%	53.8%	92.9%	100.0%	100.0%	87.5%	92.3%	78.6%
	300-600 sow	Count	7	15					1	23
		% within Size of hog operation	30.4%	65.2%					4.3%	100.0%
		% within Frequency manure is spread	15.6%	38.5%					7.7%	15.9%
	601-1200 sow	Count		2	1					3
		% within Size of hog operation		66.7%	33.3%					100.0%
		% within Frequency manure is spread		5.1%	7.1%					2.1%
	1201-2400 sow	Count	2							2
		% within Size of hog operation	100.0%							100.0%
		% within Frequency manure is spread	4.4%							1.4%
	> 2400 sow	Count	1	1				1		3
		% within Size of hog operation	33.3%	33.3%				33.3%		100.0%
		% within Frequency manure is spread	2.2%	2.6%				12.5%		2.1%
Total		Count	45	39	14	18	8	8	13	145
		% within Size of hog operation	31.0%	26.9%	9.7%	12.4%	5.5%	5.5%	9.0%	100.0%
		% within Frequency manure is spread	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

TABLE 61:

Size of hog operation * Method of manure application - Surface spread Crosstabulation

			Method of manure application - Surface spread		
			Yes	No	Total
Size of hog operation	< 300 sow	Count	16	105	121
		% within Size of hog operation	13.2%	86.8%	100.0%
		% within Method of manure application - Surface spread	88.9%	78.4%	79.6%
	300-600 sow	Count	2	21	23
		% within Size of hog operation	8.7%	91.3%	100.0%
		% within Method of manure application - Surface spread	11.1%	15.7%	15.1%
	601-1200 sow	Count		3	3
		% within Size of hog operation		100.0%	100.0%
		% within Method of manure application - Surface spread		2.2%	2.0%
	1201-2400 sow	Count		2	2
		% within Size of hog operation		100.0%	100.0%
		% within Method of manure application - Surface spread		1.5%	1.3%
	> 2400 sow	Count		3	3
		% within Size of hog operation		100.0%	100.0%
		% within Method of manure application - Surface spread		2.2%	2.0%
Total		Count	18	134	152
		% within Size of hog operation	11.8%	88.2%	100.0%
		% within Method of manure application - Surface spread	100.0%	100.0%	100.0%

TABLE 62:

Size of hog operation * Method of manure application - Surface spread & incorporation Crosstabulation

			Method of manure application - Surface spread & incorporation		
			Yes	No	Total
Size of hog operation	< 300 sow	Count	78	43	121
		% within Size of hog operation	64.5%	35.5%	100.0%
		% within Method of manure application - Surface spread & incorporation	96.3%	60.6%	79.6%
	300-600 sow	Count	2	21	23
		% within Size of hog operation	8.7%	91.3%	100.0%
		% within Method of manure application - Surface spread & incorporation	2.5%	29.6%	15.1%
	601-1200 sow	Count	1	2	3
		% within Size of hog operation	33.3%	66.7%	100.0%
		% within Method of manure application - Surface spread & incorporation	1.2%	2.8%	2.0%
	1201-2400 sow	Count		2	2
		% within Size of hog operation		100.0%	100.0%
		% within Method of manure application - Surface spread & incorporation		2.8%	1.3%
	> 2400 sow	Count		3	3
		% within Size of hog operation		100.0%	100.0%
		% within Method of manure application - Surface spread & incorporation		4.2%	2.0%
Total		Count	81	71	152
		% within Size of hog operation	53.3%	46.7%	100.0%
		% within Method of manure application - Surface spread & incorporation	100.0%	100.0%	100.0%

TABLE 63:

Size of hog operation * Method of manure application - Low disturbance injection Crosstabulation

			Method of manure application - Low disturbance injection		
			Yes	No	Total
Size of hog operation	< 300 sow	Count	22	99	121
		% within Size of hog operation	18.2%	81.8%	100.0%
		% within Method of manure application - Low disturbance injection	44.9%	96.1%	79.6%
	300-600 sow	Count	20	3	23
		% within Size of hog operation	87.0%	13.0%	100.0%
		% within Method of manure application - Low disturbance injection	40.8%	2.9%	15.1%
	601-1200 sow	Count	2	1	3
		% within Size of hog operation	66.7%	33.3%	100.0%
		% within Method of manure application - Low disturbance injection	4.1%	1.0%	2.0%
	1201-2400 sow	Count	2		2
		% within Size of hog operation	100.0%		100.0%
		% within Method of manure application - Low disturbance injection	4.1%		1.3%
	> 2400 sow	Count	3		3
		% within Size of hog operation	100.0%		100.0%
		% within Method of manure application - Low disturbance injection	6.1%		2.0%
Total		Count	49	103	152
		% within Size of hog operation	32.2%	67.8%	100.0%
		% within Method of manure application - Low disturbance injection	100.0%	100.0%	100.0%

TABLE 64:

Size of hog operation * Method of manure application - Irrigation Crosstabulation

			Method of manure application - Irrigation		
			Yes	No	Total
Size of hog operation	< 300 sow	Count	3	118	121
		% within Size of hog operation	2.5%	97.5%	100.0%
		% within Method of manure application - Irrigation	75.0%	79.7%	79.6%
	300-600 sow	Count		23	23
		% within Size of hog operation		100.0%	100.0%
		% within Method of manure application - Irrigation		15.5%	15.1%
	601-1200 sow	Count		3	3
		% within Size of hog operation		100.0%	100.0%
		% within Method of manure application - Irrigation		2.0%	2.0%
	1201-2400 sow	Count		2	2
		% within Size of hog operation		100.0%	100.0%
		% within Method of manure application - Irrigation		1.4%	1.3%
	> 2400 sow	Count	1	2	3
		% within Size of hog operation	33.3%	66.7%	100.0%
		% within Method of manure application - Irrigation	25.0%	1.4%	2.0%
Total		Count	4	148	152
		% within Size of hog operation	2.6%	97.4%	100.0%
		% within Method of manure application - Irrigation	100.0%	100.0%	100.0%

TABLE 65:

Approximate annual cost of manure application * Method of manure application - Surface spread Crosstabulation

			Method of manure application - Surface spread		
			Yes	No	Total
Approximate annual cost of manure application	< $1,000	Count	15	85	100
		% within Approximate annual cost of manure application	15.0%	85.0%	100.0%
		% within Method of manure application - Surface spread	62.5%	48.6%	50.3%
	$1,000-$5000	Count	4	41	45
		% within Approximate annual cost of manure application	8.9%	91.1%	100.0%
		% within Method of manure application - Surface spread	16.7%	23.4%	22.6%
	$5,001-$10,000	Count		17	17
		% within Approximate annual cost of manure application		100.0%	100.0%
		% within Method of manure application - Surface spread		9.7%	8.5%
	> $10,000	Count	3	32	35
		% within Approximate annual cost of manure application	8.6%	91.4%	100.0%
		% within Method of manure application - Surface spread	12.5%	18.3%	17.6%
	Not sure	Count	2		2
		% within Approximate annual cost of manure application	100.0%		100.0%
		% within Method of manure application - Surface spread	8.3%		1.0%
Total		Count	24	175	199
		% within Approximate annual cost of manure application	12.1%	87.9%	100.0%
		% within Method of manure application - Surface spread	100.0%	100.0%	100.0%

TABLE 66:

Approximate annual cost of manure application * Method of manure application - Surface spread & incorporation Crosstabulation

			Method of manure application - Surface spread & incorporation		
			Yes	No	Total
Approximate annual cost of manure application	< $1,000	Count	79	21	100
		% within Approximate annual cost of manure application	79.0%	21.0%	100.0%
		% within Method of manure application - Surface spread & incorporation	67.5%	25.6%	50.3%
	$1,000-$5000	Count	31	14	45
		% within Approximate annual cost of manure application	68.9%	31.1%	100.0%
		% within Method of manure application - Surface spread & incorporation	26.5%	17.1%	22.6%
	$5,001-$10,000	Count	5	12	17
		% within Approximate annual cost of manure application	29.4%	70.6%	100.0%
		% within Method of manure application - Surface spread & incorporation	4.3%	14.6%	8.5%
	> $10,000	Count	2	33	35
		% within Approximate annual cost of manure application	5.7%	94.3%	100.0%
		% within Method of manure application - Surface spread & incorporation	1.7%	40.2%	17.6%
	Not sure	Count		2	2
		% within Approximate annual cost of manure application		100.0%	100.0%
		% within Method of manure application - Surface spread & incorporation		2.4%	1.0%
Total		Count	117	82	199
		% within Approximate annual cost of manure application	58.8%	41.2%	100.0%
		% within Method of manure application - Surface spread & incorporation	100.0%	100.0%	100.0%

TABLE 67:

Approximate annual cost of manure application * Method of manure application - Low disturbance injection Crosstabulation

			Method of manure application - Low disturbance injection		
			Yes	No	Total
Approximate annual cost of manure application	< $1,000	Count	2	98	100
		% within Approximate annual cost of manure application	2.0%	98.0%	100.0%
		% within Method of manure application - Low disturbance injection	3.5%	69.5%	50.5%
	$1,000-$5000	Count	11	33	44
		% within Approximate annual cost of manure application	25.0%	75.0%	100.0%
		% within Method of manure application - Low disturbance injection	19.3%	23.4%	22.2%
	$5,001-$10,000	Count	12	5	17
		% within Approximate annual cost of manure application	70.6%	29.4%	100.0%
		% within Method of manure application - Low disturbance injection	21.1%	3.5%	8.6%
	> $10,000	Count	32	3	35
		% within Approximate annual cost of manure application	91.4%	8.6%	100.0%
		% within Method of manure application - Low disturbance injection	56.1%	2.1%	17.7%
	Not sure	Count		2	2
		% within Approximate annual cost of manure application		100.0%	100.0%
		% within Method of manure application - Low disturbance injection		1.4%	1.0%
Total		Count	57	141	198
		% within Approximate annual cost of manure application	28.8%	71.2%	100.0%
		% within Method of manure application - Low disturbance injection	100.0%	100.0%	100.0%

TABLE 68:

Approximate annual cost of manure application * Method of manure application - Irrigation Crosstabulation

			Method of manure application - Irrigation		
			Yes	No	Total
Approximate annual cost of manure application	< $1,000	Count	2	98	100
		% within Approximate annual cost of manure application	2.0%	98.0%	100.0%
		% within Method of manure application - Irrigation	50.0%	50.3%	50.3%
	$1,000-$5000	Count	1	44	45
		% within Approximate annual cost of manure application	2.2%	97.8%	100.0%
		% within Method of manure application - Irrigation	25.0%	22.6%	22.6%
	$5,001-$10,000	Count		17	17
		% within Approximate annual cost of manure application		100.0%	100.0%
		% within Method of manure application - Irrigation		8.7%	8.5%
	> $10,000	Count	1	34	35
		% within Approximate annual cost of manure application	2.9%	97.1%	100.0%
		% within Method of manure application - Irrigation	25.0%	17.4%	17.6%
	Not sure	Count		2	2
		% within Approximate annual cost of manure application		100.0%	100.0%
		% within Method of manure application - Irrigation		1.0%	1.0%
Total		Count	4	195	199
		% within Approximate annual cost of manure application	2.0%	98.0%	100.0%
		% within Method of manure application - Irrigation	100.0%	100.0%	100.0%

TABLE 69:

Type of outside storage * Method of manure application - Surface spread Crosstabulation

			Method of manure application - Surface spread		
			Yes	No	Total
Type of outside storage	Concrete or Steel Tank	Count	2	26	28
		% within Type of outside storage	7.1%	92.9%	100.0%
		% within Method of manure application - Surface spread	20.0%	21.7%	21.5%
	Earthen Manure Storage (EMS)	Count	5	61	66
		% within Type of outside storage	7.6%	92.4%	100.0%
		% within Method of manure application - Surface spread	50.0%	50.8%	50.8%
	Stockpile	Count	3	33	36
		% within Type of outside storage	8.3%	91.7%	100.0%
		% within Method of manure application - Surface spread	30.0%	27.5%	27.7%
Total		Count	10	120	130
		% within Type of outside storage	7.7%	92.3%	100.0%
		% within Method of manure application - Surface spread	100.0%	100.0%	100.0%

TABLE 70:

Type of outside storage * Method of manure application - Surface spread & incorporation Crosstabulation

			Method of manure application - Surface spread & incorporation		
			Yes	No	Total
Type of outside storage	Concrete or Steel Tank	Count	18	10	28
		% within Type of outside storage	64.3%	35.7%	100.0%
		% within Method of manure application - Surface spread & incorporation	27.3%	15.6%	21.5%
	Earthen Manure Storage (EMS)	Count	15	51	66
		% within Type of outside storage	22.7%	77.3%	100.0%
		% within Method of manure application - Surface spread & incorporation	22.7%	79.7%	50.8%
	Stockpile	Count	33	3	36
		% within Type of outside storage	91.7%	8.3%	100.0%
		% within Method of manure application - Surface spread & incorporation	50.0%	4.7%	27.7%
Total		Count	66	64	130
		% within Type of outside storage	50.8%	49.2%	100.0%
		% within Method of manure application - Surface spread & incorporation	100.0%	100.0%	100.0%

TABLE 71:

Type of outside storage * Method of manure application - Low disturbance injection Crosstabulation

			Method of manure application - Low disturbance injection		
			Yes	No	Total
Type of outside storage	Concrete or Steel Tank	Count	7	21	28
		% within Type of outside storage	25.0%	75.0%	100.0%
		% within Method of manure application - Low disturbance injection	12.5%	28.4%	21.5%
	Earthen Manure Storage (EMS)	Count	49	17	66
		% within Type of outside storage	74.2%	25.8%	100.0%
		% within Method of manure application - Low disturbance injection	87.5%	23.0%	50.8%
	Stockpile	Count		36	36
		% within Type of outside storage		100.0%	100.0%
		% within Method of manure application - Low disturbance injection		48.6%	27.7%
Total		Count	56	74	130
		% within Type of outside storage	43.1%	56.9%	100.0%
		% within Method of manure application - Low disturbance injection	100.0%	100.0%	100.0%

TABLE 72:

Type of outside storage * Method of manure application - Irrigation Crosstabulation

			Method of manure application - Irrigation		
			Yes	No	Total
Type of outside storage	Concrete or Steel Tank	Count	1	27	28
		% within Type of outside storage	3.6%	96.4%	100.0%
		% within Method of manure application - Irrigation	33.3%	21.3%	21.5%
	Earthen Manure Storage (EMS)	Count	2	64	66
		% within Type of outside storage	3.0%	97.0%	100.0%
		% within Method of manure application - Irrigation	66.7%	50.4%	50.8%
	Stockpile	Count		36	36
		% within Type of outside storage		100.0%	100.0%
		% within Method of manure application - Irrigation		28.3%	27.7%
Total		Count	3	127	130
		% within Type of outside storage	2.3%	97.7%	100.0%
		% within Method of manure application - Irrigation	100.0%	100.0%	100.0%

TABLE 73:

Size of hog operation * Feed or ration management for control of manure production, nutrients, or odor Crosstabulation

			Feed or ration management for control of manure production, nutrients, or odor		
			Yes	No	Total
Size of hog operation	< 300 sow	Count	29	93	122
		% within Size of hog operation	23.8%	76.2%	100.0%
		% within Feed or ration management for control of manure production, nutrients, or odor	59.2%	89.4%	79.7%
	300-600 sow	Count	15	8	23
		% within Size of hog operation	65.2%	34.8%	100.0%
		% within Feed or ration management for control of manure production, nutrients, or odor	30.6%	7.7%	15.0%
	601-1200 sow	Count	1	2	3
		% within Size of hog operation	33.3%	66.7%	100.0%
		% within Feed or ration management for control of manure production, nutrients, or odor	2.0%	1.9%	2.0%
	1201-2400 sow	Count	1	1	2
		% within Size of hog operation	50.0%	50.0%	100.0%
		% within Feed or ration management for control of manure production, nutrients, or odor	2.0%	1.0%	1.3%
	> 2400 sow	Count	3		3
		% within Size of hog operation	100.0%		100.0%
		% within Feed or ration management for control of manure production, nutrients, or odor	6.1%		2.0%
Total		Count	49	104	153
		% within Size of hog operation	32.0%	68.0%	100.0%
		% within Feed or ration management for control of manure production, nutrients, or odor	100.0%	100.0%	100.0%

TABLE 74:

Size of hog operation * Use of pit additives Crosstabulation

			Use of pit additives			
			Yes, satisfied with additive results	Yes, unsatisfied with additive results	No	Total
Size of hog operation	< 300 sow	Count	12	5	54	71
		% within Size of hog operation	16.9%	7.0%	76.1%	100.0%
		% within Use of pit additives	46.2%	62.5%	79.4%	69.6%
	300-600 sow	Count	13	2	8	23
		% within Size of hog operation	56.5%	8.7%	34.8%	100.0%
		% within Use of pit additives	50.0%	25.0%	11.8%	22.5%
	601-1200 sow	Count			3	3
		% within Size of hog operation			100.0%	100.0%
		% within Use of pit additives			4.4%	2.9%
	1201-2400 sow	Count	1		1	2
		% within Size of hog operation	50.0%		50.0%	100.0%
		% within Use of pit additives	3.8%		1.5%	2.0%
	> 2400 sow	Count		1	2	3
		% within Size of hog operation		33.3%	66.7%	100.0%
		% within Use of pit additives		12.5%	2.9%	2.9%
Total		Count	26	8	68	102
		% within Size of hog operation	25.5%	7.8%	66.7%	100.0%
		% within Use of pit additives	100.0%	100.0%	100.0%	100.0%

TABLE 75:

Size of hog operation * Test soil Crosstabulation

			Test soil		
			Yes	No	Total
Size of hog operation	< 300 sow	Count	45	77	122
		% within Size of hog operation	36.9%	63.1%	100.0%
		% within Test soil	64.3%	92.8%	79.7%
	300-600 sow	Count	18	5	23
		% within Size of hog operation	78.3%	21.7%	100.0%
		% within Test soil	25.7%	6.0%	15.0%
	601-1200 sow	Count	3		3
		% within Size of hog operation	100.0%		100.0%
		% within Test soil	4.3%		2.0%
	1201-2400 sow	Count	1	1	2
		% within Size of hog operation	50.0%	50.0%	100.0%
		% within Test soil	1.4%	1.2%	1.3%
	> 2400 sow	Count	3		3
		% within Size of hog operation	100.0%		100.0%
		% within Test soil	4.3%		2.0%
Total		Count	70	83	153
		% within Size of hog operation	45.8%	54.2%	100.0%
		% within Test soil	100.0%	100.0%	100.0%

TABLE 76:

Size of hog operation * Test for manure nutrient content Crosstabulation

			Test for manure nutrient content		
			Yes	No	Total
Size of hog operation	< 300 sow	Count	5	117	122
		% within Size of hog operation	4.1%	95.9%	100.0%
		% within Test for manure nutrient content	29.4%	86.0%	79.7%
	300-600 sow	Count	6	17	23
		% within Size of hog operation	26.1%	73.9%	100.0%
		% within Test for manure nutrient content	35.3%	12.5%	15.0%
	601-1200 sow	Count	2	1	3
		% within Size of hog operation	66.7%	33.3%	100.0%
		% within Test for manure nutrient content	11.8%	.7%	2.0%
	1201-2400 sow	Count	1	1	2
		% within Size of hog operation	50.0%	50.0%	100.0%
		% within Test for manure nutrient content	5.9%	.7%	1.3%
	> 2400 sow	Count	3		3
		% within Size of hog operation	100.0%		100.0%
		% within Test for manure nutrient content	17.6%		2.0%
Total		Count	17	136	153
		% within Size of hog operation	11.1%	88.9%	100.0%
		% within Test for manure nutrient content	100.0%	100.0%	100.0%

TABLE 77:

Size of hog operation * Consideration of other methods of manure management Crosstabulation

			Consideration of other methods of manure management		
			Yes	No	Total
Size of hog operation	< 300 sow	Count	19	103	122
		% within Size of hog operation	15.6%	84.4%	100.0%
		% within Consideration of other methods of manure management	73.1%	81.1%	79.7%
	300-600 sow	Count	2	21	23
		% within Size of hog operation	8.7%	91.3%	100.0%
		% within Consideration of other methods of manure management	7.7%	16.5%	15.0%
	601-1200 sow	Count	2	1	3
		% within Size of hog operation	66.7%	33.3%	100.0%
		% within Consideration of other methods of manure management	7.7%	.8%	2.0%
	1201-2400 sow	Count	2		2
		% within Size of hog operation	100.0%		100.0%
		% within Consideration of other methods of manure management	7.7%		1.3%
	> 2400 sow	Count	1	2	3
		% within Size of hog operation	33.3%	66.7%	100.0%
		% within Consideration of other methods of manure management	3.8%	1.6%	2.0%
Total		Count	26	127	153
		% within Size of hog operation	17.0%	83.0%	100.0%
		% within Consideration of other methods of manure management	100.0%	100.0%	100.0%

Index of Cross Tabulation Tables

Table 51: Type of hog operation & Expansion of operations 50
Table 52: Size of hog operation & Expansion of operations 50
Table 53: Size of hog operation & Nature of expansion 51
Table 54: Size of hog operation & Concerns from neighbours over manure storage or application.. 52
Table 55: Size of hog operation & Quantity of manure handled annually..... 53
Table 56: Size of hog operation & Type of manure system..... 53
Table 57: Size of hog operation & Type of outside storage..... 54
Table 58: Use of storage covers & Type of storage cover used & Type of outside storage..... 55
Table 59: Size of hog operation & Approximate annual cost of manure application..... 56
Table 60: Size of hog operation & Frequency manure is spread..... 57
Table 61: Size of hog operation & Method of manure application – Surface Spread..... 58
Table 62: Size of hog operation & Method of manure application – Surface spread & incorporation..... 59
Table 63: Size of hog operation & Method of manure application – Injection..... 60
Table 64: Size of hog operation & Method of manure application – Irrigation..... 61
Table 65: Approximate annual cost of manure application & Method of manure application – Surface Spread..... 62
Table 66: Approximate annual cost of manure application & Method of manure application – Surface spread & incorporation..... 63
Table 67: Approximate annual cost of manure application & Method of manure application – Injection..... 64
Table 68: Approximate annual cost of manure application & Method of manure application – Irrigation..... 65
Table 69: Type of outside storage & Method of manure application – Surface Spread..... 66
Table 70: Type of outside storage & Method of manure application – Surface spread & incorporation..... 67
Table 71: Type of outside storage & Method of manure application – Injection..... 68
Table 72: Type of outside storage & Method of manure application – Irrigation..... 69
Table 73: Size of hog operation & Feed or ration management 70
Table 74: Size of hog operation & Use of pit additives..... 71
Table 75: Size of hog operation & Test Soil..... 72
Table 76: Size of hog operation & Test for Manure Nutrient Content..... 73
Table 77: Size of hog operation & Consideration of other methods of manure management..... 74